AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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An Unique Manufacturing Establishment.

In Dayton, O., there is a large factory devoted to the production of machinery, which factory is conducted upon a plan that is in many important respects entirely different from that of any other with which we are acquainted. In fact, if we consider what is the usual and the generally accepted method of managing factories, if we think what the typical proprietor or manager of a factory will probably do in any given case, we may expect the proprietors and managers of this particular factory to do something entirely different, if not diametrically opposite.

And yet this factory, and the business enterprise of which it is a part, is successful; not, in spite of the fact, that it ignores most of the traditions of factory management, but, as the proprietors believe, largely *because* it ignores these traditions and has struck out upon original lines—lines which have secured for it the services of the most enthusiastic and loyal body of employés it has ever been our good fortune and our pleasure to meet.

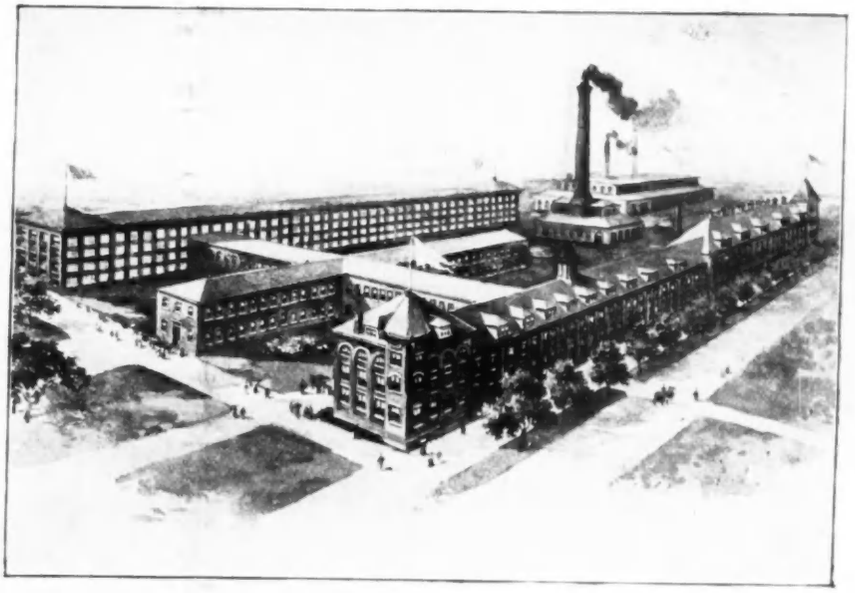
Such being the facts, it is certainly worth while for those who have to do with workshops in any capacity to know something of this one. No one interested in the problems attending the successful management of industrial operations should fail to embrace the first opportunity to visit this factory. He may be sure of a welcome within its hospitable doors, and will almost inevitably get new ideas of value to him. But, as not everyone interested can do this, we purpose to give, in this and some future articles, an idea of what the place is like, and of the spirit that pervades it.

ITS PRODUCT.

This factory is devoted to the production of one thing—cash registers. It is only within a few years past that these machines have become a familiar feature of retail stores, restaurants, etc., and the popular conception of their functions is that they simply prevent dishonesty—"knocking down"—by those who handle others' money. As a matter of fact, however, they fulfill besides this, other important functions in the systematic and orderly conduct of a retail business, and may even be used to advantage in connection with the management of a large manufacturing establishment, as is proven by the economically advantageous use of them in the factory where they are made—that of the National Cash Register Company.

ITS PROPRIETORS.

So far as we know, the Patterson brothers—John H. and F. J., respectively President and Vice-President of the company—originally had no special training in the art of managing such a business. Some years ago they had invested some money in a then entirely new invention—a machine for keeping account of cash. For some reason they sold most of their interest in it, and, afterward, the purchaser becoming dissatisfied or discouraged, they took back their stock, and with its re-acquisition, formed the determination to develop the machine, make it mechanically perfect, and educate the cash-handling public up to an appreciation of its great value. How they have done all this is an interesting story, but too long to be printed here, and our readers are more concerned with the factory as it stands, and with the unique methods employed in managing it.

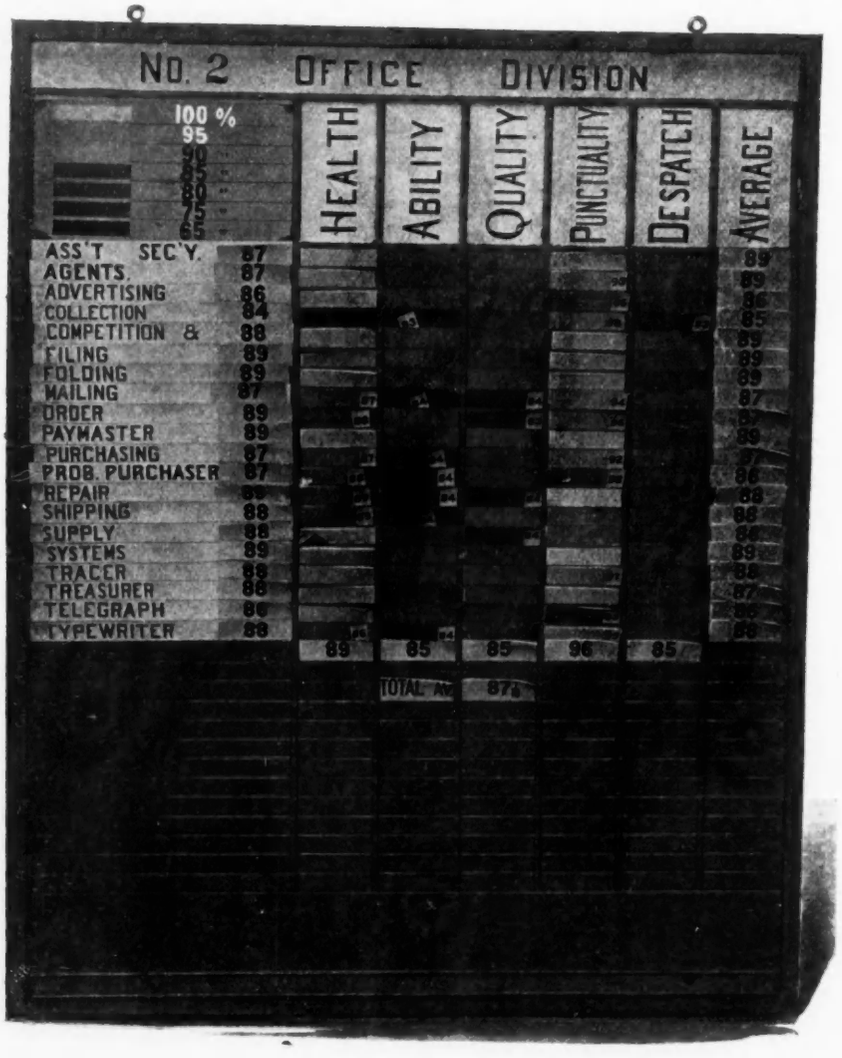


BIRD'S-EYE VIEW OF FACTORY OF NATIONAL CASH REGISTER COMPANY, DAYTON, O.

INFORMATION FOR COMPETITORS.

If a man who proposed to go into the business of manufacturing any given machine, should attempt to get information regarding the methods pursued by the leading establishment in the same line, the proprietors of that leading establishment would almost certainly see to it that his pursuit of knowledge in that particular direction were rendered as nearly fruitless as might be, saying: "We have paid for our experience and knowledge of this business, let others also pay if they wish to acquire it. It is no part of our business to educate others to compete with us." The diametrically opposite course pursued here is, perhaps, as good an illustration of the originality of the methods pursued in this establishment as could be cited. The would-be competitor is here cordially welcomed; he is taken through the factory and shown everything he cares to see; all his questions are frankly answered; he sees all the tools and machinery; sees

figures of their cost, verified by the shop records if he pleases; sees the model room, where are stored models of all the cash registers ever made or invented; and is finally taken through what is called a department of the "Midway Plaisance," where, in sheds forming a hollow square and occupying a space about 330 x 96 feet, are stored in systematic order the cash registers that have failed, because those who undertook to make them have, for one reason or another, been unable to continue in the business, and have resigned the struggle—usually after exhausting all the capital at their command. Here, in orderly groups, may be seen the entire stock of cash registers, together with the special tools designed to build them—constituting the final total assets of many a promising enterprise, whose managers found that the unequal fight could no longer be kept up; that the National Cash Register Company, with its numberless patents, and its magnificent selling and manufacturing organization, could put upon the market a better machine at a lower cost.



MONITOR BOARD.

After this tour, the seeker after information is prepared to accept the statements that about $1,500,000 are invested in the business; that within the past dozen years companies, whose combined capital amounted to $12,000,000, have been formed to compete with this one; and that as nearly as can be estimated, the losses by them have amounted to $1,812,000. He not only believes these statements, but, if he is discreet, also realizes their full significance.

This, it is true, is what is called "securing a monopoly"; but we think there can be no possible economic or other objection to it. Cash registers are not a necessity of life. Anyone who chooses can do business without them, thus contributing nothing to the "monopoly." And he will contribute nothing until convinced that he is to receive full value in return for his money.

That this monopoly, so maintained, is managed upon a liberal and broad-minded plan, is shown by the fact that prices of the product have been reduced from time to time as improvements in manufacture have permitted, a cash register which they formerly found willing purchasers for at $300 being now sold at $75; while, on the other hand, few, if any, other bodies of employés in this country are so well situated and have so much reason to be entirely satisfied with their lot.

We give herewith a general view of the more important buildings constituting the manufacturing plant. These include about 8½ acres of floor space; give employment to about 1,400 employés, besides 300 salesmen, etc.; and, as the policy of buying from other makers whatever can be advantageously purchased (gray iron and malleable castings, drop forgings, cabinet work, etc.) is followed, about 1,000 men are thus employed in tributary industries.

MANAGEMENT BY COMMITTEES.

In many factories we find the proprietor taking pride in the fact that he knows every detail of his business. "Nothing goes on here that I don't all about." "I never can find anyone to look after things as I want them to." Here we find just the opposite position taken. The Messrs. Patterson freely admit others can do things as well and even better than themselves, and that to have them do so is only a matter of careful selection of men, careful training of them, and so arranging as to call out their best efforts—their heartiest co-operation in the general plan of operations.

There is no shop superintendent, but, instead, the management is effected by a system of committees; the President and Vice-President being ex-officio members of all committees, and acting in an advisory capacity. The Executive Committee, composed of the other six officers of the company, controls the general policy of the business, and conducts its affairs. The Managing Agent and the Managing Director have general charge of the selling force, the Assistant Secretary of the recording force, and the Secretary of the manufacturing force; but all important matters are settled in the Executive Committee meetings, though each of the officers of the company acts independently in his own department as much as possible. Only matters of the greatest importance are referred to the President and Vice-President, so that a large portion of their time may be devoted to the study of methods for enlarging and extending the business.

Instead of a superintendent, there is a Factory Committee, which is composed of experts in various lines of factory work. One member of this committee acts as it chairman each month, in regular rotation. The committee meets once a day, and oftener when necessary, for general consultation, and a majority can always act. This committee is composed of five members, each of whom is in turn chairman of one or more of the eight committees having charge of the different departments of manufacturing.

During the month in which a given

PORTION OF LOCK AND DRILL DEPARTMENT (THIRD FLOOR), ADMINISTRATION BUILDING.

A CORNER IN INDICATOR DEPARTMENT.

member of this Factory Committee acts as its chairman, he usually makes a daily tour of the factory, to see how things are going, and, if possible, to perceive opportunities for improvement; but he takes no important action individually, referring all such matters to the Factory Committee, which, after discussion, decides by vote what action shall be taken. Though a majority vote decides, it is found in practice that the decisions by this committee are generally by a unanimous vote, and it is also found that what one chairman may overlook, owing to lack of personal interest in a given department, or for any other reason, the next month's chairman, or the next one, will be apt to attend to. Also, that the committee, as a whole, will be free from "fads"; will not devote an undue amount of attention to one department, to the detriment of another; and is, in a sense, entirely free from selfish personal ambition; pursues no objects not clearly in the interest of the company; has no favorites, no personal enemies to punish, nor friends to favor or reward.

AN EXAMPLE OF METHOD OF MANAGEMENT.

As an example of how the work of these committees is done, we will suppose that a blacksmith brings up a matter in connection with the work, and speaks to the foreman of that department about it. The foreman may decide it; but if, for any reason, he does not think best to do so, he will take it to that member of the Factory Committee who has charge of the smithing department, along with others, among which are the tool-making, assembling a certain machine (the "No. 33"), tool-grinding, tool supply, etc.; and is at the same time chairman of the "No. 33 Committee" (having in direct charge all matters pertaining specially to the No. 33 machine), and also of the Fire Committee. The matter might be settled by this man, or by the committee of which he is chairman, or he might refer it to the Factory Committee for final decision. Should it be unsettled here, it would go to the Executive Committee and, if they were unable to decide, one of the Messrs. Patterson would finally be consulted.

By this system of committees the care of the details of the business is removed from the officers to the company, so that they may devote their time to the more important matters. By this plan there is always a number of men holding positions of responsibility who are familiar with what is being done, with the reasons for any given decision or line of procedure, and who feel that interest and desire for success which comes from a sense of personal responsibility.

PARTICIPATION OF ALL EMPLOYÉS.

Carrying this idea still further, every employé is given the fullest knowledge of the business of the various departments, so that all may act intelligently. There are frequent meetings of the entire factory force, which meetings, in the summer, are held under the trees in the grove adjoining the factory. Everyone is expected to make suggestions, and all who desire to speak are encouraged to do so. In winter, such meetings are held in the lecture hall owned by the company. A general convention of the sales agents from all over the world is held yearly, lasting a week, and at one or more of the sessions of this convention the entire factory force is present; the object being to make them familiar with the wants of the agents, and be in touch with them; to realize something of the nature of the work done to secure orders; and to know how the factory as a whole, and each individual employed in it, can best assist this important portion of the work.

There is also what is called the "Advance Club," which meets every Friday afternoon, and is composed of the officers of the company, the Factory Committee, the heads of the office departments, all foremen and sub-foremen, besides twenty-five people from the factory force, who are selected each week by the foremen. For the

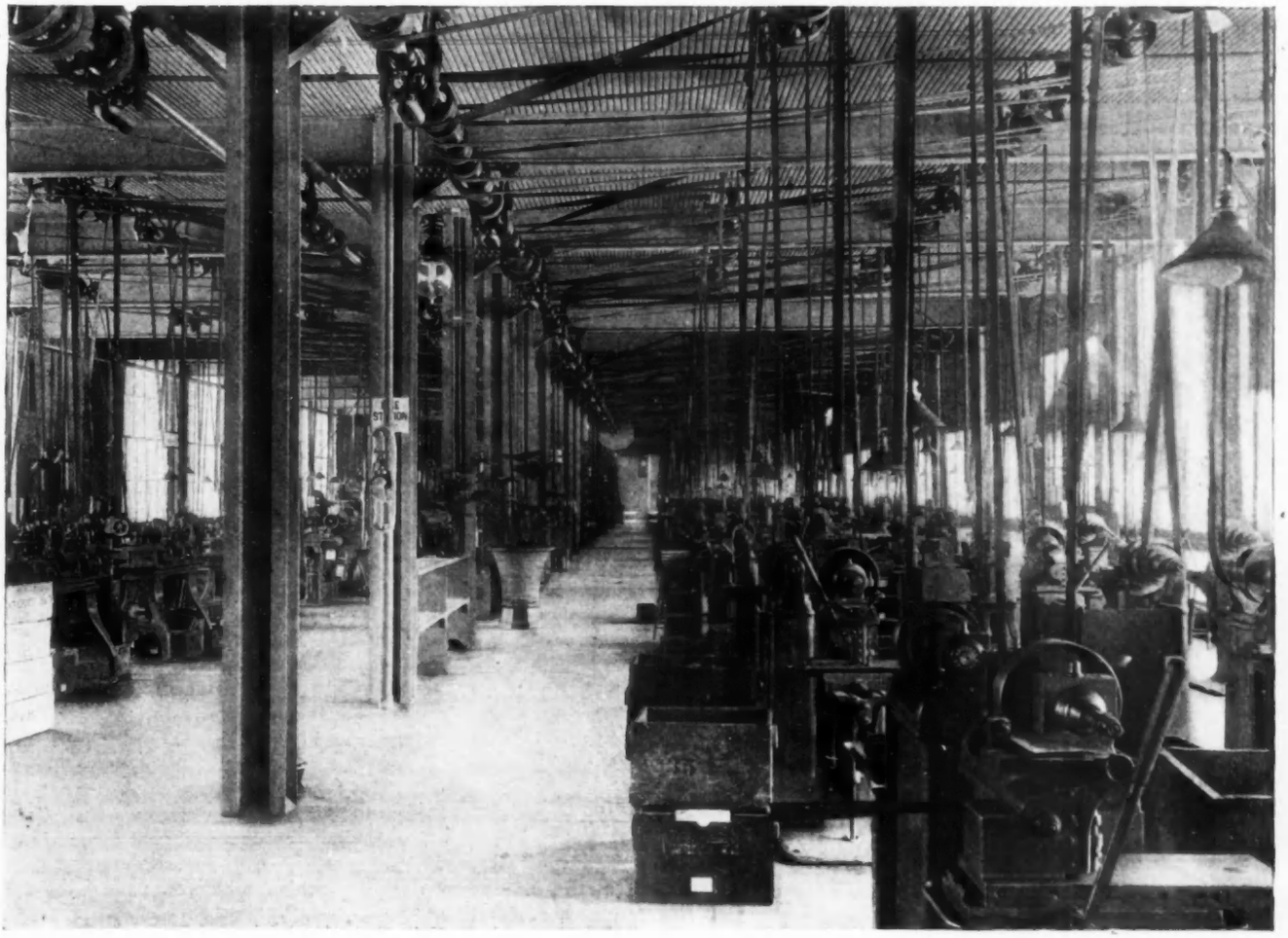
YOUNG WOMEN'S DINING HALL (FOURTH FLOOR).

meetings of this club a regular program is arranged, and all complaints and suggestions from the various departments are received and carefully considered. Each member of the Advance Club is called upon to speak on subjects pertaining to his particular department, or those of particular interest, at least once every three months.

SUGGESTIONS AND COMPLAINTS.

Any employé, from the newest boy hired to move stock, to the oldest and most experienced head of an important department, or any salesman or office boy, can make suggestions or enter a complaint, and to facilitate his doing it, there are a number of autographic registers placed about the shops, which are placarded, "Suggestions and Complaints." Any employé who wishes to make use of one of these, simply steps up to it, writes what he wishes upon the strip of paper, makes sketches if he desires, turns the crank, tears off and retains that portion of the slip he has used, while the carbon copy of what he has written goes onto a roll within the register, and is sure to receive attention by the committee having charge of the department of work to which it pertains, by the Advance Club, or by the Factory Committee, or by one or both of the Messrs. Patterson, if necessary.

Twice a year $250 in gold are paid in various prizes for the best suggestions made during the previous six months, and some of the best and most valuable things practiced here, both mechanical and administrative, have been adopted from suggestions so received, or in the effort to correct some evil complained of in this manner. Foremen and sub-foremen are not eligible for these prizes; but some of the leading men, belonging to what is called the Officers' Club, receive a commission on all sales of registers.



A VIEW OF "MACHINERY HALL," SHOWING PALMS.

"MONITOR BOARDS."

What are called "monitor boards" are used to indicate the relative standing and efficiency of the different departments, and these monitor boards are publicly exhibited in various portions of the factory, besides being printed in a journal called "The N. C. R.," a semi-monthly pamphlet, published by the company and given to all employés at the factory and on the road, for their information and instruction.

We give herewith an engraving of one of these monitor boards as it appeared at the time of our visit, choosing that for the "office division" only because it happened to be in the best position for photographing. The list at the left begins with the title of the officer who has charge of the office work, and below are designated the several divisions of that work. The board is so arranged that cards of various colors can be inserted in slits, as shown, and these cards bear figures indicating the rating of that particular department in respect to Health, Ability, Quality of Work, Punctuality and Dispatch.

Cards of the lower ratings are progressively darker in tint, so that a horizontal strip across the board, darker or lighter in color, indicates at a glance the relative standing of that department.

The fact that the rating of the "Collection" department is lowest on this board, would naturally be taken as evidence that the company had been having the common experience with difficult collections, and that special difficulties might not always be allowed for in fixing these ratings, whatever might be done with conclusions drawn from them. Inquiry on this point, however, brought out the fact that this rating is due to other causes, and that collections have recently been fully up to the average.

Monitor board No. 3, which is for the "making division," is more extensive,

containing the ratings for forty-six departments, under the heads of Health, Ability, Quality, Quantity and Cost.

The rating shown on these boards is changed each week, and the department having the highest average rating for each month is awarded a silk banner, suitably inscribed, which it retains during the succeeding month, and longer if its standing justifies; for, though this monitor-board system and banner-awarding may seem to partake a little of the kindergarten, it is nevertheless taken seriously enough in the factory, and it is a well-settled fact that the high monitor-board rating and the banner are eagerly striven for, and that, almost without exception, every employé, whether he be a drill-press boy, a floor-sweeper, or a foreman, has his eye on the rating and the banner, and it is a common experience to hear a machine tender who, by a mistake, has spoiled a lot of work, lament, chiefly, its adverse effect upon the monitor board of his department—his regret being intensified by the knowledge that all his fellow-workmen in the same department are affected equally by it. This community of interest also tends toward co-operation, each man not only desiring to do well himself, but being also interested in having all others in his department do as well, which, as most of us know, means very much in manufacturing operations.

Besides, there may be something more substantial than the mere possession of a banner. The Blacksmith, Final Inspection, Indicator Dipping, Experimental No. 1, Experimental No. 2, Paymasters and Shipping departments, all went on an excursion to Cincinnati, recently, as guests of the company, and without loss of time, because they had won the banner during 1896.

In planning and carrying out the methods of administration which have thus been outlined, the Messrs. Patterson have not aimed at mere novelty; they by no means impress one as being in the least visionary, but, on the contrary, are what are known as "hard-headed business men." The administrative plan has been a growth, and each feature, as it has been added, has been subjected to a rigid test, and shown to be economicaliy advantageous—in accordance with "sound business principles." In other words, it pays.

ATTRACTIVE FEATURES.

There are many features about the factory which would generally be regarded as purely luxuries. Some might be even inclined to critise them as "out of place," and especially is this true of the purely ornamental features. It is the belief of the Messrs. Patterson, however, that these attractive features pay in the business sense, to say nothing of the pleasure and satisfaction derived from them. This belief is not a mere notion based upon a taste for refined surroundings, but is a deliberate conclusion reached as a result of experience and careful consideration. It is a belief firmly held here that pleasant surroundings conduce to the economical production of good work, aside from the fact that they attract the better class of men. Not only by paying good wages, but by giving unusual attention to matters of sanitation, cleanliness, light, good ventilation, heating and ornamentation, does this company endeavor to attract to its service the best class of men and women, and to call out their best efforts, mental and manual.

INTERIOR VIEW OF OFFICERS' CLUB DINING HALL.

For instance, some landscape gardening has been indulged in, and the exquisitely good taste of this work is sufficiently attested by the fact that it was planned by Frederick Law Ohmstead, who designed New York's Central Park and the grounds at the World's Fair, Chicago. In the matter of color, also, this was not chosen haphazard, but an expert in such matters was called in, who, after making a study of all the conditions, prescribed a shade known as colonial yellow. This forms a good background for the shrubbery, and inside, where not only the walls but also the painted portions of all machinery are of this color, the effect is pleasing and satisfactory in every respect.

Floors and machines are kept scrupulously clean; cuspidors are provided for the spitters; all stock not being actually operated upon is kept in the "Clearance House"; and throughout the factory, in places chosen to give a pleasing effect, carefully tended and thriving palms grow in pots, which, at the time of the writer's visit, were covered by thickly gathered red crêpe tissue paper—this being, probably, the work of a committee from the young women employed in the factory, which committee has supervision of all decorations used about the establishment.

We give an interior view of a portion of what is known as "Machinery Hall." It is fairly representative of the appearance of the shops as one passes through them, except that the photograph, having been taken when the room was deserted, fails to show the workmen, who themselves form one of the most interesting features of the place.

All young women employed in the factory, whether in the office force or in the "making division," work less than 8 hours a day, for which they receive 10 hours' pay. They have a fifteen-minute recess during the morning, and again during the afternoon. They have a Saturday afternoon holiday, and other holidays at intervals. They are furnished with aprons and oversleeves, which are also laundried free of charge. They come to work a little later and go home a little earlier than the men, in order that they may avoid the crowded trolley cars.

The young women are employed only in the lighter and more cleanly parts of the work; they work seated, and a portion of the intermissions previously referred to is spent by them, and in fact by the entire office force as well, in calisthenic exercises, which are carried on under the direction of a competent teacher. This break in the half-day's otherwise steady grind has been demonstrated to be a very great advantage to those employed in sedentary occupations. It sets the blood in active circulation, expands the lungs, relieves the tension of tired nerves, and does much to maintain the establishment's carefully guarded standard of health.

At the noon hour, luncheon is served to the women in the dining room, a view of which is shown. This, while not expensively, is yet tastefully fitted up, is reached by one of the shop elevators, seen at the right; and here, free of charge, coffee or tea, a good soup, and some other requisites of a satisfactory luncheon, are supplied, to which the girls can and do add whatever their fancy dictates, from their own lunch-baskets.

At the right, rear of this view of the dining room, is the curtained entrance to a retiring room, which somewhat resembles a small hospital ward, but is more cheerful. Here are a number of cots which are for the use at any time of any woman who is indisposed and wishes to lie down for a time. The writer was shown into this room because, at the time, a brass sign at the entrance displayed the word "Unoccupied." If any indisposed young woman had been within, the brass sign would have been reversed to display the word "Occupied," and no intrusion would have been permitted.

Adjoining a different portion of the dining room is a well-fitted up bathing establishment for the women, and this they are permitted and encouraged to use "upon the company's time."

THE OFFICERS' CLUB.

The Officers' Club, which has been previously referred to, has its headquarters in a small cottage standing between the street and the shop buildings; and here, every day, the members composing it, who are the officers of the company and the heads of important departments, to the number of about eighteen, have dinner served upon the 16-foot circular table. Sales agents and other guests are often entertained here also. The menu is first-class, as a personal experience testifies, and, while it is receiving attention, matters pertaining to the business naturally come under discussion; and thus, in a most natural and pleasant way, there is a daily interchange of ideas and of experience, which, aside from the real pleasure of it all, is believed to make the money spent in the maintenance of this club a profitable investment for the company.

For the men, besides the attractions already mentioned, there are shower-baths for their use, "on the company's time"; aprons provided at cost, and laundried free of cost; a free library; an occasional voluntary reduction of hours of labor, without reduction of wages, so that now they work 9½ hours for 10 hours' pay, six months' guaranteed prices on piecework for those who work by the piece; but above all, perhaps, the substantial evidence that effort of any kind on behalf of the company is appreciated and will in some way be rewarded; that little room is left for the play of that form of jealousy and envy which sometimes prevents such appreciation of devotion to a company's interests; and that every employé has a right to consider himself interested in the company beyond his mere daily wage.

In a future article we shall attempt to give some further and more detailed account of things to be seen in this remarkable establishment.

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Another Oil Swindle.

We are at a loss to understand what occult influence apparently so actively tends to the demoralization of the seller of oils. A large oil firm of Philadelphia reports that at least two oil salesmen (of a rival concern) are effecting sales of cylinder oils which they handle by contriving to put bi-carbonate of soda or borax or some alkali into their competitor's oil when the two oils come in competition in actual trial. The oil so doctored turns to a milky color and clogs the feed. The lowest grades of cylinder oil make a better showing than high grade oil if the latter is doctored as above. The probable explanation of the oil swindler is the contributing ignorance of the customer, an ignorance which we are constantly laboring to dispel.

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The Cleveland oil swindlers have devised a new name, and the latest edition is the Zone Oil Company. Mr. J. G. Peterson, who has a plumbing establishment in Battle Creek, Mich., sends us the first proposition we have received issued by the Zone Oil Company, but it is very like all the other companies, and Mr. Peterson says: "Thanks to your paper, I do not want the oil."

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The Tuskegee Normal and Industrial Institute has recently fitted up a machine and engineering department, with improved tools and appliances, also using compressed air in some of the theory and practice work.

A Notable Milling Cutter.

We present herewith some engravings of a milling cutter which is remarkable for its method of construction as well as for its size, which latter is unusual, as indicated by the figured drawings which form a portion of our illustrations.

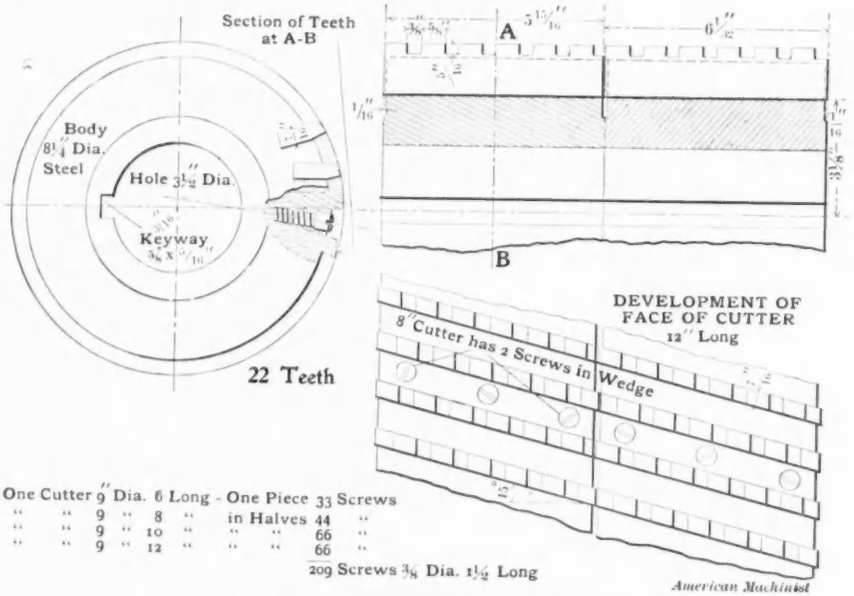
This cutter was made for the Newton Machine Tool Works, of Philadelphia, Pa., who furnished to the Brazilian Government a large number of milling machines to be used by the Central Railway of Brazil. The cutter was made by the Morse Twist Drill and Machine Company, of New Bedford, Mass., and, as will be seen, is an inserted tooth cutter made in two pieces, one $5\frac{15}{16}$ inches long, and the other $6\frac{1}{2}$ inches long, the diameter over all being 9 inches, and of the body $8\frac{1}{4}$ inches.

A LARGE MILLING CUTTER.

The body of the cutter is of machinery steel, and the method of securing the cutters is plainly indicated by the photograph and drawing. The front faces of these teeth are at all points of their length radial; that is to say, the front faces form a helix, but the grooves in which the teeth are inserted are not helices, but are simply straight grooves milled at an angle. The cutters are thicker at their outer edges than where they enter the body of the mill, and after they had been fitted the cutter was put into the milling machine, which was geared to cut the proper helix or spiral, and the front faces were in this manner made radial at all

points of their length in the usual manner.

In the photograph, the arrangement of the gaps in the cutters makes it appear as though they were cut in the lathe in the same manner as in screw-cutting; we are informed, however, that this plan was not adopted, and that it is not considered a good one in making such cutters, because it prevents one side of each gap from clearing. The method adopted in this case was to put each alternate cutter in place, cut the gaps in them at regular intervals, then remove them and put the other alternate set of cutters in place, and similarly groove these, arranging so that the gap in one set comes behind the cutting portion of the alternate set.


Section of Teeth at A-B
Body 8¼″ Dia. Steel
Hole 3½″ Dia.
Keyway
22 Teeth
A
B
DEVELOPMENT OF FACE OF CUTTER
12″ Long
8″ Cutter has 2 Screws in Wedge
One Cutter 9″ Dia. 6 Long - One Piece 33 Screws
" " 9 " 8 " in Halves 44 "
" " 9 " 10 " " " 66 "
" " 9 " 12 " " " 66 "
209 Screws ⅜ Dia. 1½ Long
American Machinist

WORKING DRAWING OF LARGE CUTTER.

This makes a very efficient cutter in respect of both quantity and quality of its work, and one which can readily be made new by fitting a new set of teeth.

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Repairs of Electrical Machinery—VI.

BY A. R. HARRIS.

Inasmuch as a multipolar armature is substantially the equivalent of a number of two-pole armatures all merged into one, it is only natural that a man who does not fully understand the connections of the former with the commutator, and the way in which the currents circulate through the coils, should draw wrong conclusions as to the modifications of the connections that are permissible. Suppose such a man has, say, an eight-pole generator, wound in parallel, and capable of delivering a current with a pressure of 110 volts, and that for some reason he desires a current with a pressure much higher than this. As the machine would be provided with eight brushes, and as he would know that the current would have the pressure of 110 volts imparted to it in passing from one brush to an adjoining one, it would be quite natural for him to suppose that if the second brush were connected with the third, the current would pass a second time through the armature, running from brush 3 to brush 4, and come out at the latter with a pressure of 220 volts; and if passed in this way all around the circle, that the final pressure would be 440 volts instead of 110. Again, he might have a series-wound generator with two brushes, and this might give a higher pressure than desired, and it would be natural for him, if reasoning in the same manner as with the parallel-wound machine, to conclude that by adding extra brushes the voltage of the current would be cut down. Neither one of these results can be accomplished, but the attempt to do it has been made several times, to the writer's knowledge, and therefore it is reasonable to assume that such a procedure is not at all uncommon. To show why these results cannot be obtained, let us consider the parallel-wound armature first, one of which, of the eight-pole type, is shown diagrammatically in Fig. 1.

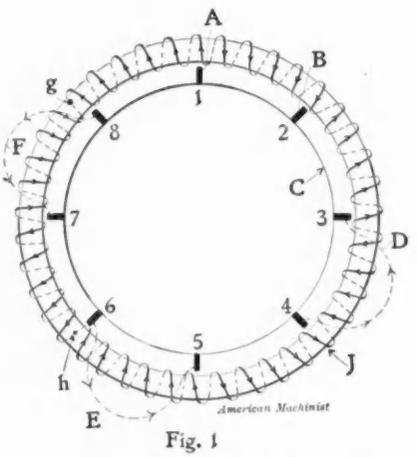


Fig. 1

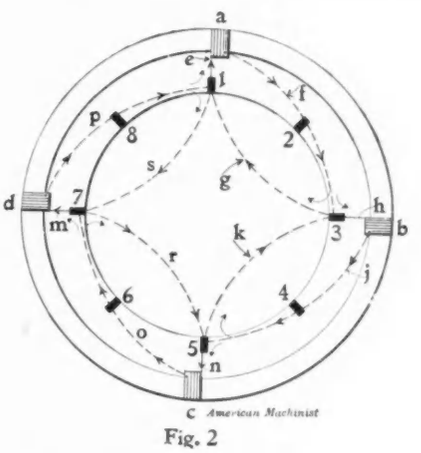


Fig. 2

IMPOSSIBLE ARMATURE CONNECTIONS.

If an armature of this type is properly connected, the alternate brushes 1, 3, 5, 7 will be connected electrically, and so will the brushes 2, 4, 6, 8. Now, it is quite natural that at a first glance the impression should be created that if the current, after passing from brush 2 to brush 3 through the armature coils, is carried to brush 4 by means of the wire *D*, that it will continue through the armature from where it enters through the latter brush and come out at brush 5 with the extra pressure due to the effect of the armature between the last two brushes. From this it would be assumed that if the current is led off from brush 5 its pressure would be twice as great as if taken from brush 3, and further, that if it is passed still further, going by wire *E* to brush 6, and from brush 7, by wire *F*, to brush 8, it would come out at brush 1, with four times the pressure. If, however, we consider the conditions that will obtain, with the presence of these connecting wires *D E F* between the brushes that they connect, we will be able to see at once that there is a decided stumbling block in the way that will prevent the attainment of the anticipated results. This stumbling block is nothing more nor less than the fact that the wires *D E F* short-circuit the sections of the armature between the brushes they connect. Thus the current generated in the wire between brushes 3 and 4 can pass from one brush to the other by way of the wire *D*, just as well as by following the circuit around the whole armature, and as the former path would be so much easier, it would practically neglect the latter; hence, there would be very little current flowing in the circuit proper of the machine, but in each of the three circuits formed by the wires *D E* and *F*, there would be sufficient to burn out the wire wound upon the armature. At a first glance it would be inferred that only those portions included between the brushes 3-4, 5-6, 7-8 would be affected, but on further reflection it will be seen that as

the armature rotates, every part will come into these positions included in the short circuits; hence, all the wire would be heated.

Now consider the effect with a series-wound eight-pole armature, in which an attempt is made to reduce the voltage by adding more brushes. From what has already been said about this type of winding, it will be remembered that with it the proper number of brushes is two. If six more are added, so as to make the number equal to the number of poles, the inference would be that as only one-quarter as much wire on the armature would be effective between each set of brushes, the voltage would be reduced to one-quarter, and the current quadrupled. By referring to Fig. 2, it will be readily seen that this result would not be obtained. As was shown in a previous article, if an eight-pole armature is connected in series, the coils are cross-connected in such a way that the inside end of one connects with the outside end of another one-quarter of the circumference ahead of it. Thus, starting with coil *a*, the outside end of it would be connected with the commutator directly opposite to it, and the inside end would be connected with the commutator one-quarter of the circle in advance, and to the same segment. The outside end of coil *b* would also be connected, the inside end of this coil being connected with the commutator segment opposite coil *c*, to which the outside end of the latter would also be connected. The inside end of coil *c* would be connected with the segment of the commutator opposite coil *d*, to which the outside end of this coil would also be connected. The inside end of coil *d* would connect with a segment, one ahead of the one to which the outside end of coil *a* is connected. These connections are shown in the figure by the full lines *e h n m* and the dotted line *f j o p*. Now, if eight brushes are placed as shown at the points 1, 2, 3, 4, 5, 6, 7, 8, the odd-numbered ones will have to be connected with each other, as indicated by the dotted lines *g k r s*, and this would also be true of the even-numbered brushes. To avoid confusion, the connections between the even-numbered ones have been left out, as they are not necessary for the purpose of illustrating the action which takes place, the action with reference to one set of brushes being the same as the other. The proper path of the current would be from coil *a* through wire *f* to coil *b*, and thence to coil *c* and coil *d*, and from here to the coil one in advance of coil *a*, from which point another excursion around the circle would be made, passing through the coils one in advance of those first traversed. The second excursion would take the third set of coils, and after a sufficient number of excursions all the wire would be traversed in series and the current would come out at brush 2. This would be the result with only two brushes in use, but where eight are placed in the positions shown, the current passing from coil *a* to coil *b* by wire *f* would return to the starting-point through the connection *g* between brushes 1 and 3. The same would be the result in all the quadrants, as is shown by arrowheads, the current in coil *b* returning to the starting point by wires *j* and *k*, and from coil *c* by wires *o* and *r*, and from coil *d* by wires *s* and *p*.

On account of these short circuits, the pressure developed by the generator would be very low, but it would be sufficient to generate a very strong current in the short-circuited coils, on account of the very low resistance of these, and as all the coils would come into the short-circuiting position one after the other, the whole armature would become overheated, and if not stopped in time would be burned out.

From the foregoing it will be seen that a parallel-wound armature cannot be changed to the series connection by simply connecting the brushes in series, and that a series-wound armature cannot be changed to the parallel type by adding extra brushes. The only way in which an armature can be changed from one type of winding to the other is by disconnecting the commutator, and connecting it with the ends of the coils connected in the proper order for the type of winding desired.

▲ ▲ ▲

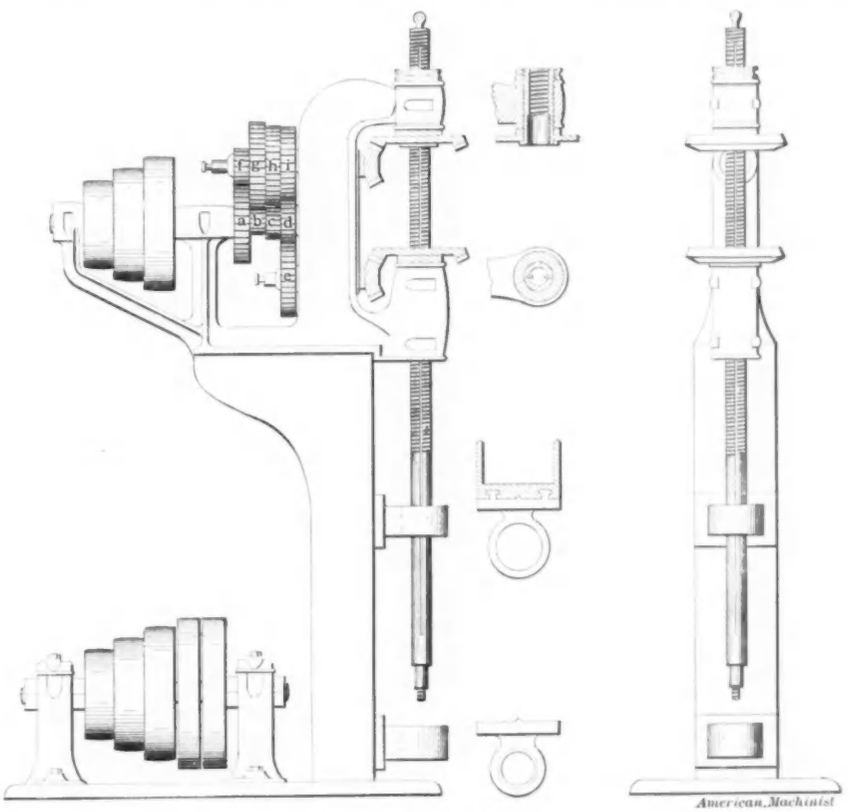
Machine for Boring Molds for Printers' Rolls.

In connection with the recently published communication from Mr. Henry N. Binsse on the subject of boring molds for printers' rolls, we are enabled to present herewith an engraving made from working drawings of a machine designed and built by Mr. Binsse for that purpose. The general features of the machine will be readily understood from the drawings.

The upper cone pulley shaft has keyed to it four spur gears, *A B C* and *D*. Gear *D* drives gear *E* below it, which gear is keyed to a short horizontal shaft at the other end of which is a bevel pinion engaging with the bevel gear, which drives the spindle by means of the oppositely located feathers, as shown in the section at the right. Gear *E* may be connected to or disconnected from this shaft by a pull-and-push-pin connected to a sliding key, as indicated at the left of *E*.

A pull-and-push-pin above connects any one of the four gears, *F G H* and *I*, with the shaft upon which they run, and thus these gears may give to this shaft four different rates of speed. From this shaft by means of the bevel gearing shown the feed motion is derived. The screw for the feed is cut directly upon the spindle, and the feed is obtained by giving to the nut a speed of rotation differing from that of the spindle in any required degree. Gears *A* and *F* are engaged only for the rapid vertical movement of the spindle to be used as a quick return motion; the rotation of the spindle being then stopped by disconnecting the key in gear *E*.

The mold to be bored (which is an iron casting made with special care) is held in the socket shown near the bottom of the machine in front, and passes through a



MOLD BORING MACHINE.

ring at the top in which are four set screws by which it is centered and held. The boring bar as shown is run down through the mold to be bored, and the cutter or head is then attached, the feed being always upward, thus pulling the cutter through instead of pushing it.

First an ordinary double end cutter mortised into a holder is fastened to the boring bar, and this takes the roughing cut which is about 1-32 inch less in diameter than the finished size. The reamer or wood bit is then used for the finishing cut, and this is made as follows: The body of the bit is about ¼ inch less in diameter than the bore. It has six dovetailed grooves placed in it lengthwise, into which wooden strips are driven. The body is then placed between centers and turned, the upper end being finished for about 1 inch to the size left by the roughing cut. Then the finishing cutter, also double ended, follows, inserted in a mortise. Below this point the wood is turned about .01 inch larger than the finished bore. For a 3-inch bore the finishing reamer is about 7 inches long. The boring thus done is found to meet the requirements perfectly, and the requirements for modern press work on modern high speed printing presses are very strict; the mold must be very smooth, round and straight.

▲ ▲ ▲

The Construction of the Hindley Worm—I.

For more than a century the Hindley worm has been a sort of mechanical ideal. It has been published and republished in mechanical text books, but so far as we know it is only recently that it has received any extended degree of application. The descriptions given of it have been quite superficial and many of its features remained out of sight until attempts to make it brought them to the surface.

Fig. 1 is a reproduction of an engraving which appeared in the "Principles of Mechanism," by Professor Willis, first published in 1841. The larger sketch gives in crude form the general idea of the gear, while the smaller one indicates the method of its manufacture, although not in practicable form, as no method of feeding the tool into the blank is shown. In point of fact also a number of cutting tools are provided instead of the single one shown. These tools are mounted on a heavy disk, and are spaced to represent the teeth of the worm wheel, the arrangement forming a cutter head which is driven at the proper speed by connecting gearing. The feed might be accomplished by forcing these cutters radially outward, although this would be objectionable, not only on account of its complexity, but also on account of its lack of rigidity. The method actually used is therefore to bolt the teeth to the disk and cause the cutter head and worm blank to bodily approach each other as the cutting proceeds. The worm wheel is, of course, hobbed by a hob which has previously been cut in the same manner as the worm, and the theory is that the worm being cut by a cutter head which truly represents the wheel, and the wheel being cut by a hob which represents the worm, wheel and worm will then mesh together in perfect contact. How far this is true we shall see.

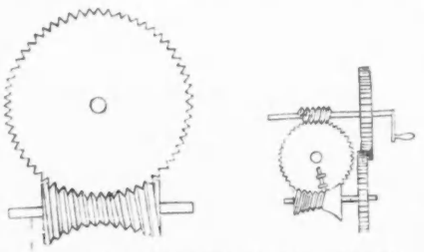


Fig. 1. THE HINDLEY WORM ACCORDING TO WILLIS.

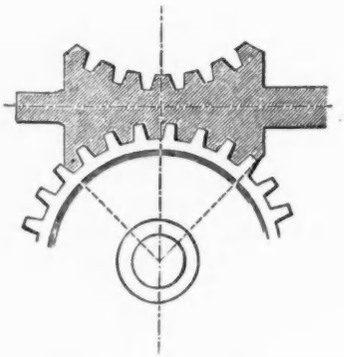


Fig. 2. THE HINDLEY WORM ACCORDING TO REULEAUX.

In practice no such crude forms of teeth as those shown would be tolerated. In point of fact the teeth are made of extra depth in order to take full advantage of the opportunity for securing good contact, and further, no such arc of contact is possible as that shown. In extending this arc of contact the teeth of the worm sooner or later become, on paper, undercut—a shape which cannot be made except with radially fed cutters, and if made, the worm and wheel could not be got together except by splitting the wheel in halves perpendicular to its shaft, and in point of fact not even then, as will be seen later, since the difficulties which have developed in the manufacture of the gear increase with the arc of contact between worm and wheel. As an indication of the superficial nature of the inquiry to which the gear has been subjected by mechanical authors, we give Fig. 2, which is reproduced from "The Constructor" by Reuleaux, which as shown above illustrates a gear which it is not practicable to make and impossible to get together if made—since splitting the wheel is obviously not contemplated. This engraving shows undercut teeth at the outer ends of the worm, while as a matter of fact the first limitation set upon the designer of this gear, is that the worm shall not be so long as to involve undercut teeth.

One point should be made, especially in view of the worms to be shown, namely, that what appears at first sight to be the characteristic feature of this worm—its hour glass shape—is not such in reality. The really essential characteristic is the feature of guiding the tool in a circular path when cutting the worm, instead of in

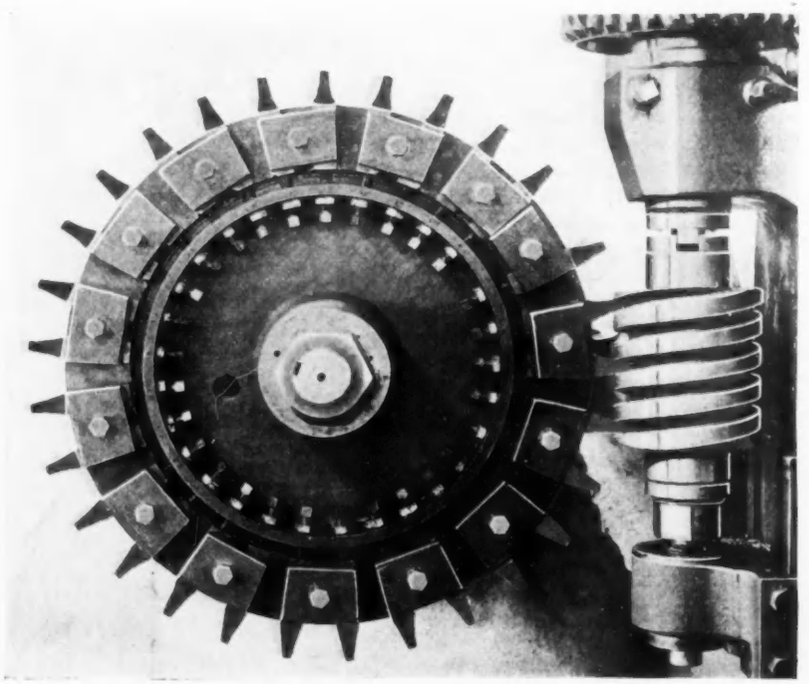


Fig. 4. THE CUTTER HEAD.

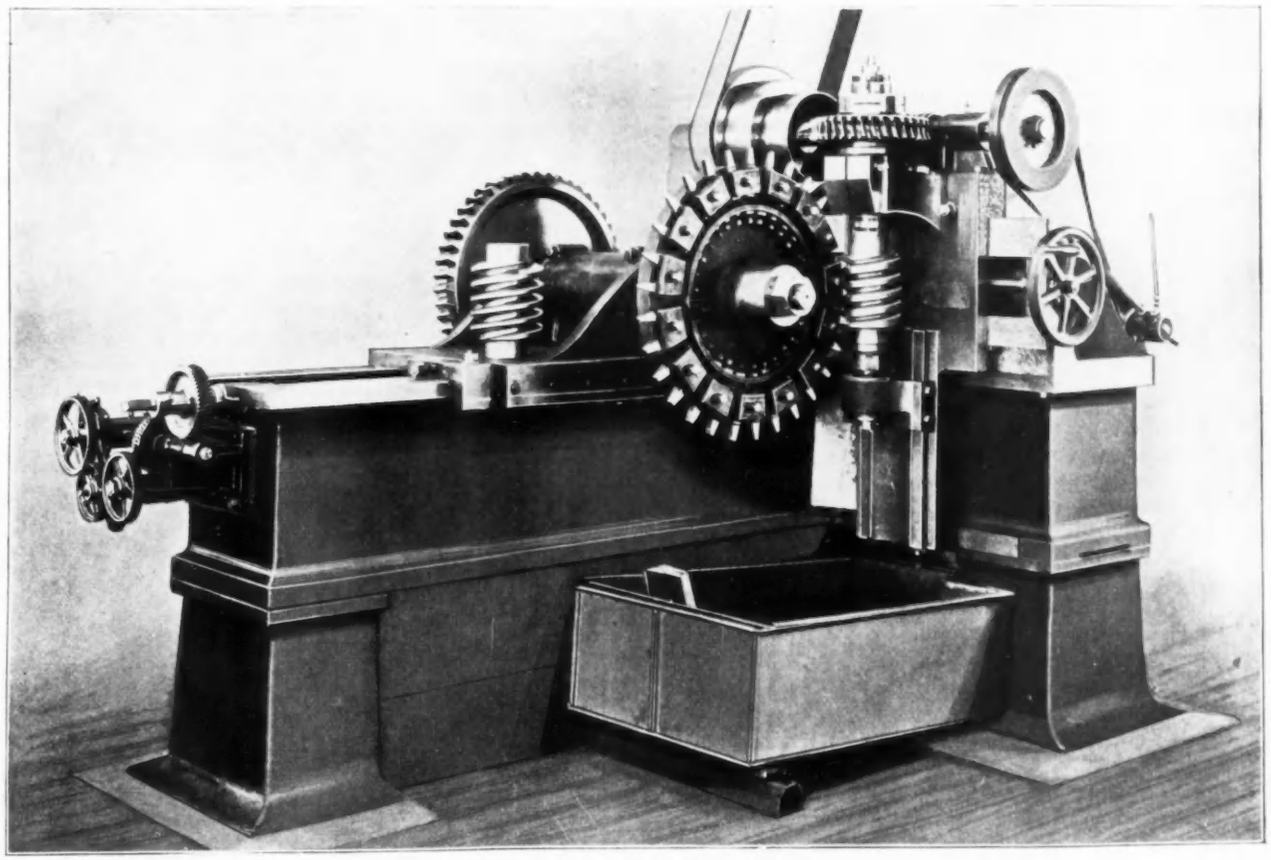


Fig. 3. CUTTING THE WORM.

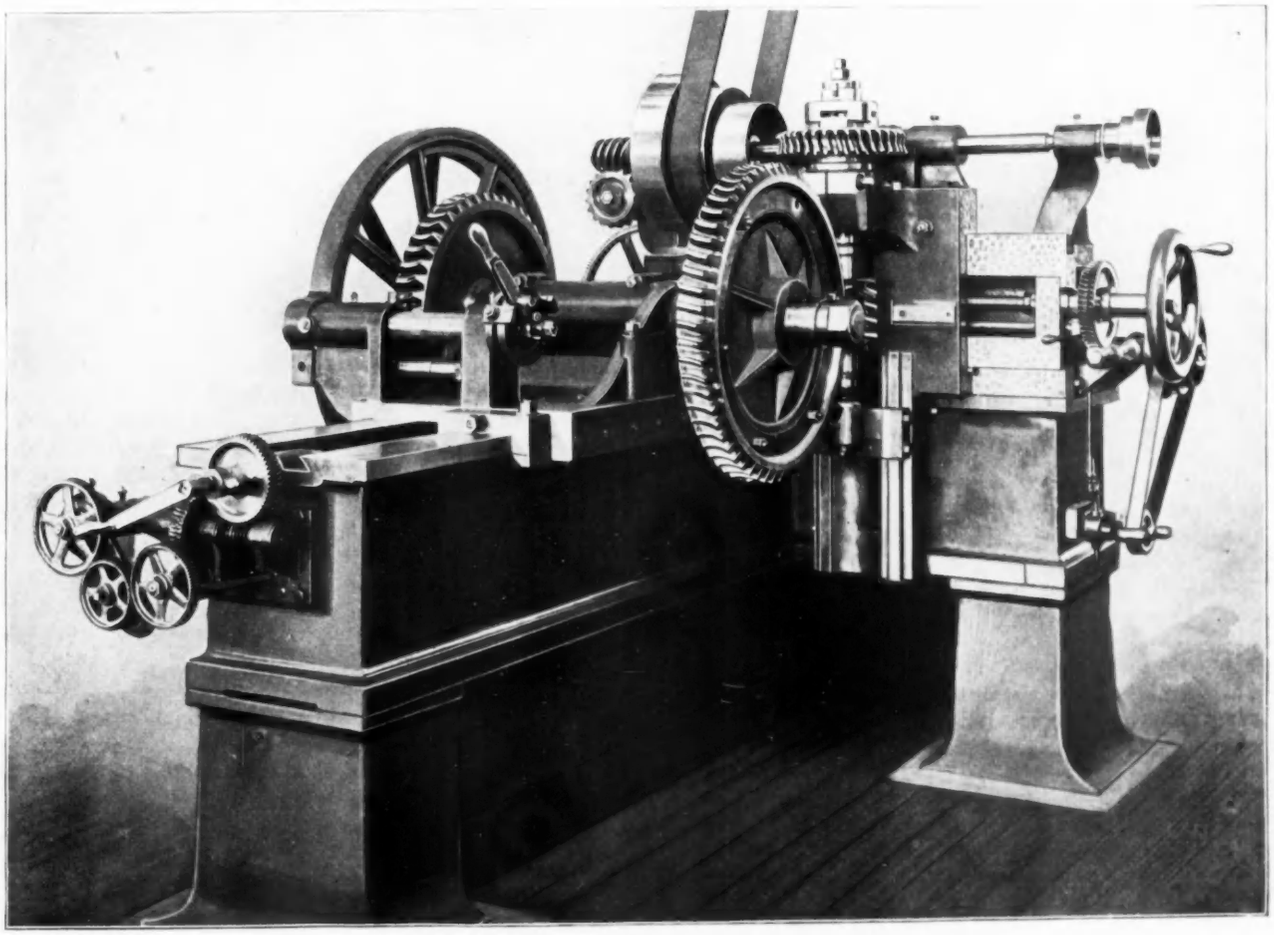


Fig. 5. HOBBING THE WHEEL.

a straight one. A common worm is cut in a lathe with the tool fed in a straight line parallel with the worm shaft, but the Hindley worm is cut with a tool which represents a tooth of the worm wheel and travels in a circle. In the worms to be shown the blank is turned straight, as with the proportions here used, and with a worm limited in length as above, the increased amount of surface in contact secured by the hour glass shape is trifling.

What follows is an account of the methods of manufacture of these worms as practiced at the works of the Sprague Electric Elevator Co. The equipment provided for the work is very superior. Much time and thought and money have been spent in learning how, and our best acknowledgements are due that company for placing their experience at our disposal, and for allowing the photographic originals of the accompanying half tones to be made.

To begin with, two superb Pratt & Whitney worm cutting machines are provided, which are duplicates, except that one of them, shown in Fig. 5, is also arranged for spur gear cutting, as will be seen by the indexing mechanism forming part of it.

Fig. 3 shows one of these machines at work cutting a worm, from which the general nature of the work will be apparent. The work is, of course, flooded with water and suitable shields are provided to keep this where it belongs. These have been removed in order to show the more essential features, but otherwise the pictures show the machines as at work. The worm in the machine has had its thread cut to about half its intended depth. A completed worm will be seen standing on the machine bed.

The construction of the cutter head is shown more clearly in Fig. 4, from which it will be seen that a tool is mounted to represent every other tooth of the wheel except that as the wheel has an odd number of teeth, the tools of the cutter head are in one place three tooth spaces apart instead of two. The tools are, of course, very carefully made, their bodies being machined and dropped into radial sockets in the disk. The head having little lateral stiffness, a guiding brace is mounted behind it, out of sight in the illustration, to prevent spring and chatter. The manner in which the worm blank and the cutter head are connected by gearing to drive them at the same speed as though the cutter were a wheel and the blank a finished worm, will be apparent.

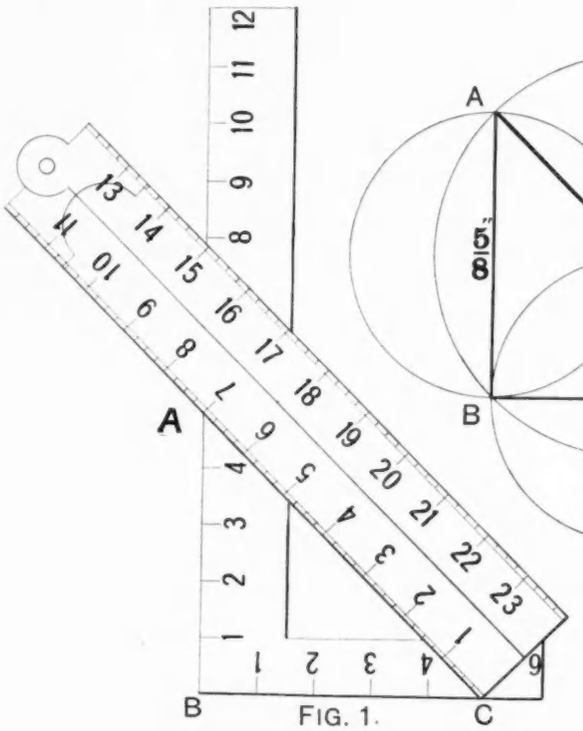
Fig. 5 shows the companion machine hobbing a worm wheel. The operation is the exact reverse of the preceding, the wheel blank being mounted in place of the previous cutter head, and a hob in place of the worm blank—the two being geared together and driven precisely as before.

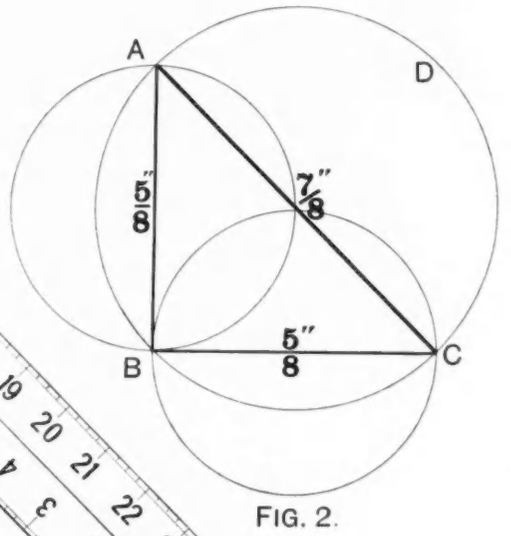
Letters from Practical Men.

"The Square of the Hypothenuse."

Editor American Machinist:

As the draughting-room is the fountain-head of knowledge, the busy draughtsman is sometimes asked by a blacksmith to "look in his book" and see what sized iron should be used, to be equal in strength to two other rods of a given size; or a plumber asks him to "look at his tables" and tell him how large a pipe would carry the flow of two smaller pipes. It is of no use to say to a blacksmith that the relative tensile strength of two rods is proportional to the squares of their diameters, or to quote "the square of the hypothenuse" to the boss of a gang of chattering Dagoes. They cannot remember the rule, because they fail to understand the principles.





THE SQUARE OF THE HYPOTHENUSE.

The blacksmith knows that a 1-inch rod is more than double the weight of two ½-inch rods, but fails to understand that it is four times as large.

The plumber is surprised to learn that if he increases the diameter of his pipe 1¼ times, he increases its capacity 1½ times. Is there any easily remembered rule, or any easily applied instrument, by which the correct result may be obtained?

Yes; if a man has any tools at all, he would have a carpenter's square and a foot-rule, and he needs no others to solve the problem. Suppose a blacksmith is forging a "turnbuckle," the sides of which are formed of two ⅝-inch rods, and he wishes to know the diameter of one rod of a strength equal to these two. Now, instead of eighths of an inch, let us consider these fractions as inches; that is, instead of ⅝ of an inch, let us say 5 inches. Now, beginning at the corner of a square, let us lay off 5 inches each way, as *B A*, *B C*, in Fig. 1, and with a pocket rule measure the distance across from *C* to *A*, in this case nearly 7 inches; that is, one ⅞-inch rod is equal in weight and strength to two ⅝-inch rods. This is shown further in Fig. 2, where the circles show the different rods, and the fractions indicate their diameters.

Suppose, also, that our plumber wishes to know how large a pipe would be needed to carry the same volume of water as one 6-inch and one 8-inch pipe together. Taking 6 inches on one corner of the square, and 8 inches on the other, the diagonal distance is easily found to be 10 inches, which is the diameter of a a pipe equal to the combined capacity of the other two. If a steel square is not at hand, a bit of board with one square corner will answer every purpose, by marking the inches along each edge. The foot-rule alone will tell the story. Thus, there are no tables to consult, no rules to remember, and no areas to compute.

W. H. SARGENT.

St. Johnsbury, Vt.

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A Gear-Blank Arbor.

Editor American Machinist:

I have recently seen in use a very neat little device for holding gear blanks on an arbor for the purpose of turning the side and face. I send you, under another cover, a drawing of this device, which explains itself. "J. P."

[Our philosopher, upon seeing this sketch, remarked; "Yes, that is very

good; much better than some tools I have seen; but—the work is necessarily a good ways out from the lathe spindle, and the split sleeves made in that way would cost too much. Besides, it is always objectionable to arrange such sleeves so as to expand at one end only."

Then he sketched the arrangement shown at Fig. 2, in which he proposed to use a plain straight sleeve, made out of smaller stock; slit it with four slots, two

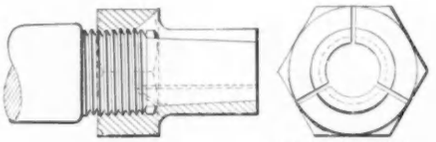

Fig. 1

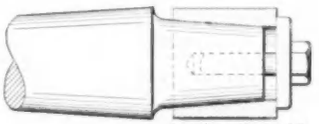

Fig. 2

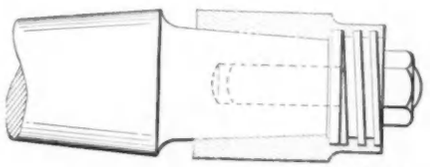

Fig. 3

GEAR-BLANK ARBORS.

from each end, so as to allow expansion at each end alike, and force it on with the common bolt and washer.

Upon being shown that, while this would force the sleeve on all right, there would be difficulty when it was desired to remove the work, he thought a moment and sketched Fig. 3, in which he proposed to use the Hunter or differential screw; the screw in this case being a solid square-threaded collar, coarser in pitch than the thread of the smaller portion. Thus arranged, the screw will pull the sleeve off as well as force it on, and with the square thread, the two slits which start from that end can pass right through the threads without harm, which, of course, would not be the case if the threads were of any other form, because the tendency would be to spread the sleeve open at the end. Though this thread-cutting will add somewhat to the expense, the sleeve will still be less expensive than that shown in Fig. 1, and it has other obvious advantages.—Ed.]

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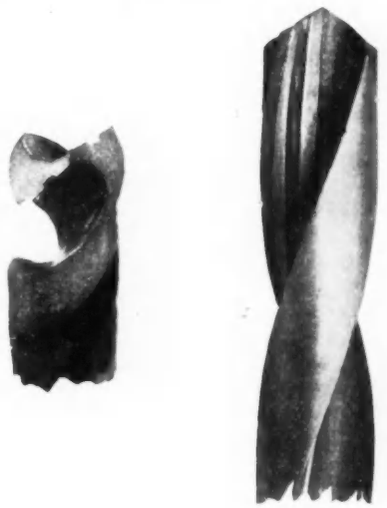
A Twist Drill Experiment.

Editor American Machinist:

Not long ago you gave a description and illustration of a German drill. That brought to mind an experiment I made in 1883 with the cutting edge of a twist drill. I was then in the employ of the Brown & Sharpe Manufacturing Company, and made a drill which I send you. Before making this drill I talked with Professor Sweet, whom I met at one of our association meetings, about the idea, and he thought it would make a good drill. When I determined that it was a free-cutting drill, I sent it to the Morse Twist Drill &



A TWIST DRILL EXPERIMENT.

Machine Company, with the idea of having them manufacture it. They wrote me that they did not think the advantages of the drill would warrant them in the manufacture. As people in the business did not deem it of value, and also as I was not making twist drills for the market, I placed it in the archives, and there it has remained until I read your article.

Other mechanics may have tried the same idea, though I had never heard of it before, nor have I known of its being done since. But your article may open up many scrap heaps that will show up ideas differing from the general practice.

GEO. H. SMITH.

Providence, R. I.

[The drill referred to is shown in the half-tone herewith. It seems to be a neat connecting link between the letter of Professor Sweet, in our issue of February 4th, and that of Mr. J. D. Fox, February 11th. We have previously explained that the drill illustrated in our issue of December 17th was an American patent, although the patentee was a German.—Ed.]

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American Machine Tools Criticised by an English Engineer.

Editor American Machinist:

Having nearly £10,000 worth of American machinery under my care, I may be pardoned for writing you on one or two points in reference thereto, thinking that they will interest your readers.

Most of the above machinery has been bought during the past five years, and I am sorry to say that I have noticed a tendency lately on the part of some firms to do too much "manufacturing" and not enough "building" in the way these terms are understood in this country. A proof of this lies in the fact that in every drill I have bought lately, the base and in some cases the table has been badly out of square with the spindle. I don't think there can be any worse feature in a drilling machine or one more easily found out and righted after the machine is put together. Neither do I think it is possible to insure the alignments being correct, without testing, even if made on the most perfect machines ever devised. No good tool builder would think of sending out a lathe having its slides left just as they came from the planer, although probably no tool in the shop turns its work out better, or even as good as a good planer.

Many of your readers will no doubt say: "Well, there is nothing easier than to face up the end of column true, and then plane the base flat." This I grant because it is a mechanical possibility to do these things, but how many of these simple easy jobs turn out right? In every case I have found the base is not flat, but has apparently been sprung by the plates which held it during the planing, and in some cases I have found the spindle has not been in line with the column. The first trouble is an easy one to put right compared with the latter, but tool builders should remember that all these little jobs in getting a tool into working condition mean that such tool has cost so much more in consequence, as such alterations cost far more than if done where the tool was made.

While on the subject of drilling machines, I would like to ask how it is that firms claiming to put the metal just where it is wanted will persist in making drills with such light, unsupported columns? There is, in most cases, no provision made to counteract the pull of the cone belt. The one cone is fixed to the bed plate, and the other to a cantilever bracket at the top of the column, and a tight belt has then a very powerful leverage to spring or deflect the column. A very light strut would obviate all this.

In lathes I have noticed another serious defect, viz., that the spindle is not in line with the bed. This is only found out in boring a long hole; and I don't think there is one American lathe in our shop, and we have some of all the best makes, which bores a parallel hole. On an English lathe this defect can be easily remedied, but it is a much more serious undertaking on an American one with raised vees.

Americans in general are credited with a desire to pander to customers' tastes, and I, among many others, wish they would turn their attention to designing a more serviceable and substantial compound rest. I have not seen a single instance where an American rest can hold a candle to a good English one especially on boring. They are much too flimsy, and the part of the top rest where the bolts go through for holding it down to the other slide is always much too thin. This leads to spring-

ing under even moderate cuts. The bottom slide is always much too narrow, but probably the worst feature of all is that apology for a vee strip [gib] so much favored by American tool makers—presumably on account of its cheapness, for it has no other good point. To spoil a good tool for a few extra pence is a very near-sighted policy. I don't think a worse strip was ever devised. The pressure is taken by only a small portion opposite each screw, and this in a direction out of square with the vee. In our opinion there are two essential points to be observed in a vee strip: (1) Means for bolting it firmly to the slide. (2) Means of side adjustment. A tapered strip operated from each end is sometimes useful, and I some time ago devised a tapered strip having the adjustment from the top thus:

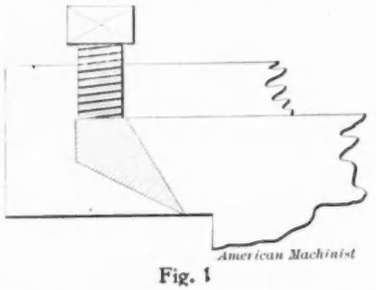

Fig. 1

but I don't think any so good as the old-fashioned strip. In some positions it can be improved by making it thus:

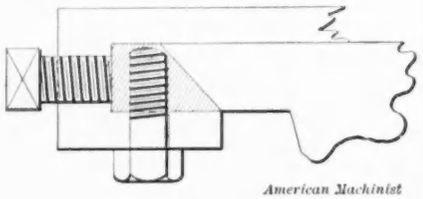

Fig. 2

It is thus pulled down to the widest face and supported all along, instead of hanging on the bolts. This, in the opinion of mechanics here, represents the very best form of strip it is possible to have. Adjusting screws should also be a tight fit or have locking nuts.

Lathes over 8-inch centers [16-inch swing] should also have four bolts and two plates in place of the usual American tool post which, in our opinion is only suitable for light lathes.

It is also a great advantage for the poppet [foot stock] to be cut away for clearance, so that the handle for top slide can be operated easier when in line with the bed. This is being done on some lathes lately.

Many poppet spindles [tail spindles] and lead-screws are also much too light. Another point I cannot understand is the making of cast-iron balanced handles by a country which boasts of introducing the hub plant for turning hubs from the solid bar. The castings must cost more per pound and are always dropping off.

In fancy I hear some of your readers saying, "Anything else?" Well, not at present, and I trust at any rate my remarks will be received in the same spirit as they are written, not with the wish to find fault, but to let the makers know what some of their customers on this side think on the subject. There is no doubt that the system pursued by American firms of turning their sole attention to one particular tool, is calculated to perfect the design and usefulness of such tool much quicker than if they tried to make all sorts. It should also cheapen the cost considerably, but herein comes the trouble I first mentioned, and all tools should be run and tested before leaving the works, if complete satisfaction is aimed at. No system, however elaborate, is of any use without this precaution.

Some of your tool-makers who are now being pressed for goods for this country will think that their product is ousting the home-made article, but when I tell them that most good tool makers here are from three to six months behind in their contracts, they will see that the present demand is an exceptional one.

H. AUSTIN,
Works Manager, The Wolseley Sheep Shearing Machine Co., Ltd
Birmingham, England.

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An Expert Eye Doctor.

Editor American Machinist:

Without attempting to criticise what has already been said upon the subject, I will give you my experience as an eye doctor, extending over some twelve or fifteen years, in different shops in the East and West. In the majority of cases I have found the substances which get into the eye in the shop to be either emery, steel or cinders. Sometimes the pattern maker will come around with an eye full of sawdust or wood borings, and for such a case I have an eye-glass, like a small goblet, whose upper edge is molded to conform to the eye cavity. By filling this with warm water and bending the head over until the glass can be put around the eye, then tipping the head back until the glass is upside down, holding it firmly in the eye cavity to prevent leakage, and then opening and shutting the eyelids, wood, and in many cases other substances, can be washed or floated off from the eye, or from under the lids. Always use warm water. I keep an alcohol lamp, such as is used frequently for heating milk for children, and a clean quart tin pail to warm water in; also, a *clean* sponge and basin are handy to bathe the eye after operating upon it with the knife. In fact, I have found that water, as warm as can be borne without inconvenience or discomfort, is one of the most soothing and agreeable applications to an inflamed eye. By closing the lids and bathing them with warm water and a sponge, I have myself experienced as much relief as by any other treatment. I have never used oil, and so I cannot speak on that point, but I should want to know more about it than a person usually does about machine shop oil before I put it into my own eyes or into others. I have used an eye-wash, however, with very good results, that used to be known around Boston years ago as "Dr. Williams' eye-wash," and could be obtained in most of the prominent drug stores there, as can the eye-glasses just alluded to. It is some preparation of camphor and borax. The use of cocaine is so universal, and the operation of removing foreign substances rendered so much easier by it, that I never think of trying for a piece without it. I use an ordinary glass medicine dropper with rubber bulb. Two drops is usually enough, although it is sometimes necessary to repeat.

In taking pieces from the eye, I use several methods, according to circumstances. An average case would be something like this: A man comes up to my bench and says: "Jim, I've got something in my eye; got it in last night, 'bout an hour 'fore quittin' time; was grindin' a diamond point on the emery wheel, an' I felt a little piece strike; didn't hurt much then. I rubbed it and thought it was out, but it's bothered me all night, an' this morning Jack's been pokin' at it with a match, but she's there yet."

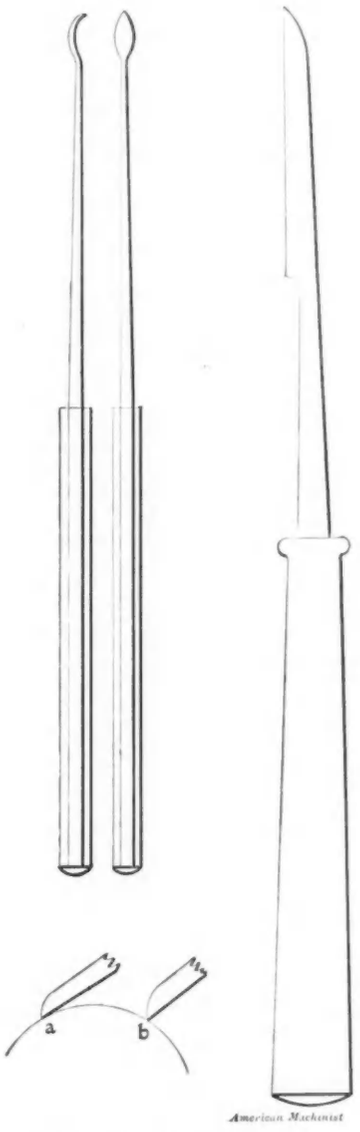
I back him up against a post where I can see; I take a little tool like the sketch, spoon-shaped, slightly dished, handle 3-16 inch diameter, octagonal or hexagonal, and with the spoon end sharpened to a fine point, the edges also. I use the handle first and roll the upper lid over on it. I lift it slightly, so that I can see under what won't roll over on the handle. If I find the piece of emery, or whatever it may be, stuck upon the under side of the lid, I take the point of a knife, sharp, or a small pointed camel's-hair brush, and remove it. I usually wind a bit of bandage around my left forefinger, if I am working with my right hand, to wipe the knife or brush on, and show the piece—partly for my own satisfaction, but more particularly for my friend's with the "bad eye." You've no idea, unless you have tried it, how much better it makes your eye feel to see the "varmint" after it is out.

Again, I have sometimes found upon the inside of the upper lid a small boil; some people are occasionally troubled with them in their nostrils as well as eyelids. When they occur upon the inside of the lid, in moving over the eye, as the eyelid is opened and shut, they rub upon the eye and irritate it. If I can see a little whitehead, I open it and wash the pus out with warm water. If it has not sufficiently ripened, I tell the man what the matter is, and that it will break of itself in a short time, and it usually does.

I have also found eyelashes in some manner grown through the lid and scratching the sensitive membrane of the eye. These I pull out with a pair of small tweezers. I use the spoon-shaped

portion of the small instrument I have just described to pick pieces off the eye itself that have not become imbedded, or to pick them out from back of the lower lid where they sometimes fall when removed from the upper lid or the eye. I never leave a loose piece anywhere in the eye, if I know it, and trust to the chance of its working out of the corner of the eye or down the tear duct.

If I do not find anything the matter with either lid, I look the eye itself over.



THE EYE DOCTOR'S KIT.

It is quite a hard thing to find the piece if it happens to be small and not upon the white portion of the eye. I have known oculists to spend some time in looking for them with a glass, and with every convenience in the way of light, before finding them. Of course, it makes some difference about the color of the eye; light-colored ones are easier to see into than dark ones. I get as good light on the eye as I can, and something to steady the man's head with, if possible, and by having him roll his eye first in one direction, and then in another, I am pretty sure to find it. I use a glass sometimes, but with a very light setting, or with none at all, as the setting shades the eye and stops the light. After locating it I apply cocaine and wait a minute for it to produce its effect upon the eye; then if the piece has been in overnight, I take a sharp knife which I made like the sketch, point sharp and thin, and work the point under the piece and lift it out. The piece can be felt very readily the moment the knife touches it, if your hand is sensitive. The knife handle should be flat and not round, as it does not turn in the hand. It is convenient to be able to use the knife with either hand, because of the curvature of the eye. I like to use it in position *a*, and not in position *b*. With a steady hand and a still head there is little danger, but less in the first position than in the second. Often a piece of emery or steel will split in halves while removing it, and you will think you have it, when in reality you have only a part of it. Then iron or steel will rust and discolor the eye, and it will look as though there was something left when there is not.

Many people think the cocaine allays inflammation, but I have not found it so. It simply destroys for a short time the sensitiveness of the eye, and as soon as its effect passes away, the eye is as much inflamed as ever, and should be bathed and bandaged. It is always well to tie some kind of a shade, or blinder at least, over the eye, after a piece has been taken out, to protect it from the light and allow it to rest. If the cause of the inflammation has been removed carefully the eye will soon be well. There are cases, of course, too serious for shop treatment, and a man should at once be sent to an oculist, but don't, if you can help it, go to an ordinary physician; the shop eye doctor is often better. Go to an oculist, a specialist, and you will have your eye attended to properly.

When a piece has but just got into the eye, it may be often removed by pulling up the lower lid and pulling the upper lid down over it, and telling the patient to open his eye, allowing the lids to be pulled away from your fingers as you carefully hold them. This, it seems to me, is better than putting paper or eyestones in your eye. This will usually result in knocking the piece off the eye, when it can be picked out. A hot chip flying into the eye, or being caught in the lid upon the outside, by the instantaneous closing of the lid upon such occasions, is very painful, but it is usually of such weight as to fall out, or down into the lower part of the eye cavity, as soon as you unbutton your eyelid. Often a piece of steel, in flying from the lathe or planer, will strike the eye such a blow, and immediately fall away, that the eye will become so inflamed as to cause a person to think there must be something in it. I remember one case where the lid closed sufficiently quick to receive the blow, and a small blood blister formed upon the inside of the lid, and was very painful for a short time.

I usually can remove a piece from my own eye. I use cocaine, and I have a small round concave mirror, such as is used for the illumination of a microscope stage, which enlarges the eye two or three diameters, and is very convenient in locating pieces in the eye.

MACHINIST.

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The Speed of Planers.

Editor American Machinist:

I would like to say a few more words about planer speeds. For various reasons several readers of the "American Machinist" object to more than 20 feet cutting speed, some because they believe the tool will not stand, others because it is not dignified, etc.

The first objection is good so far as it goes, the others are scarcely valid in these times of sharp competition.

We are using steel which will stand considerably more than 20 feet per minute, in fact, on large castings of soft cast iron, which have no more than ⅜-inch stock to remove, we run one of our planers, which is arranged with a variable speed counter shaft, at 40 feet per minute, and no reduction in feed from that used at the old speed of 20 feet.

The tools stand this work just as well as ordinary steel cutting at the rate of 18 feet. It is not unusual for us to plane castings weighing over five thousand pounds on this planer at the rate of 40 feet per minute.

We recently roughed and finished a casting, having a solid rectangular surface 18 x 40½ inches, in 21 minutes, actual cutting time, the roughing out requiring 17 minutes, finishing 4 minutes; weight of chips removed 65 pounds, cutting speed 37 feet per minute. The tool showed no signs of giving out, and apparently could have performed the same operation many times before grinding would have been necessary.

Mr. Chappell speaks of finishing pulleys at the rate of 790 square inches of surface per hour, taking one roughing and one finishing cut, as being pretty good time. We recently finished the face of a band wheel 74 inches diameter by 8¾ inches face, taking three cuts, roughing, second and finishing. The first took 33 minutes, second 20 minutes, third 15 minutes, or at the rate of 1,745 square inches of finished surface per hour. But one tool was used for each cut.

C. S. BONSALL,
(Buckeye Engine Co.)

Salem, O.

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The gunboats "Wheeling" and "Marietta" were launched simultaneously at San Francisco on the 18th, and are reported to have collided and been injured.

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An Unique Manufacturing Establishment.

During the convention of the National Association of Manufacturers in Philadelphia a few months ago, an Ohio manufacturer delivered an address which convinced the other experienced manufacturers who formed the bulk of his audience, that the speaker had made important discoveries in the art of the management of industrial establishments.

Since that time we have had an opportunity of making a study of the factory in which these discoveries have been made and in which the ideas set forth in the address referred to have been reduced to practice.

Our long standing personal acquaintance with many of the employés of this establishment, afforded exceptional facilities for getting at the true inwardness of things connected with it, and in our leading article for this week we have attempted to give a true idea of what the factory is like, and in what respects it differs from other manufacturing establishments. Those who are familiar with such establishments will readily see that the departure in this case from "established practice" is in many respects a very radical one, and certainly the case presents many exceedingly interesting features.

So far as we know, there is no other manufactory in the world which is managed in a manner similar to this one. Its administrative features are entirely unique and one result of them is that every employé is stimulated to do his best—believes that he has a position well worth holding, and knows that efficient service of hand or of brain will be appreciated and substantially rewarded—is, in fact, made to feel that he has opportunity for the full play of all his ability and that he is in a much more complete sense than usual a participator in the success or otherwise of his department and of the factory. This, as we all know, means very much. It is the attainment of a result always striven for to some extent, and more or less intelligently, by managers of manufacturing establishments everywhere.

Whether or not the character of the service secured by this scheme of administration, and by the special attractions offered, would be found to pay in a shop whose product is in a stricter sense a competitive one, will not be conceded to be positively proven by the experience of this establishment. Those, however, who know the difference in value between an enthusiastic, ambitious, intelligent and interested workman, and one who cares for but little else besides 6 o'clock and pay day, believes there are plenty of better jobs if he could only secure one, and that his employer's interest in him extends only so far as the maximum of work for the minimum of wages, as exemplified by "Rules and Regulations," usually inconsiderate—even brutal and senseless—will not be hasty in deciding that none, nor that all, the features set forth in our article would not be applicable to any industrial establishment. At any rate, the matter is worthy of serious study.

Years ago G. R. Brown, of the Fall Brook Railroad, discarded entirely the old brutal method of maintaining discipline among railroad employés and substituted for it a rational, humane system, a system founded in a recognition of the fact that men employed in the operative department of railroads are much the same as men in other walks of life; have some self-respect and are influenced by the ordinary considerations which appeal to rational human beings everywhere. His system proved successful and within the past few years has been adopted by many other railroads, with uniformly good results for men and roads; thus again proving that long-established custom in these matters is not necessarily right, and that new administrative as well as new mechanical ideas are sometimes well worthy of serious attention.

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An English Criticism of American Machine Tools.

We print elsewhere in this issue a letter from an English works manager, which letter we think should receive careful consideration, especially by those tool builders who have or expect to have trade in foreign countries.

If it be granted that any given line of tools made here are, all things considered, superior to those made elsewhere, it by no means follows that they are superior in every respect and cannot be improved upon. On the contrary, it is certainly the part of wisdom for builders of such tools to give careful attention to fair criticism; all the more so, when it is evidently friendly, and comes from those whose ideas are based upon broad experience.

The honest opinion of an English works manager having fifty thousand dollars' worth of American machine tools in his shop, mostly purchased within the last five years, is in no case to be despised, and where it is so evidently discriminating and appreciative may well receive careful attention.

Some of the points brought up by Mr. Austin have been discussed in our columns and elsewhere, and our best mechanics have expressed opinions sustaining his views. This is notably the case with regard to our parallel strips for gibs, supported upon the points of small screws. Many of our builders have long ago discarded these, however, and we all know that drill presses can be had here with spindles in correct alignment, and that there are plenty of American lathes built that will bore parallel holes—at least within reasonable limits of accuracy.

In fact, scarcely any of Mr. Austin's criticisms fairly apply to all American tools, but it cannot, on the other hand, be denied that nearly or quite all of them do apply to some of the tools built here. He undoubtedly puts his finger upon some weak spots and it is well for those interested to consider them. Those who find themselves sensitive at these spots may well consider whether they should blame the finger or strengthen the spots.

His last paragraph is significant. The conclusion easily to be drawn from it is that those builders who now come nearest meeting all the requirements of English tool users will have the easier task in maintaining their hold on that market in a time when it may not be so easy to sell tools there as it is now.

Unfortunately, perhaps, mechanical ability and those other qualities which go into the makeup of a man who will build good tools or none are not always accompanied or supplemented by those other qualities which make what we call business enterprise, and this fact undoubt-

edly has an important bearing on the case. An establishment may send some tools abroad mainly because its tools are good ones; but another may send more of them abroad solely because there is someone connected with it who knows how and is disposed to reach out for business.

Where by reason of superior business enterprise enlisted in their behalf, tools not of the best grade are being sold abroad, just so much is being done to lower the general reputation of American machine tools in foreign countries, and thus make it more difficult for our best builders to hold their trade there when demand slackens; as it undoubtedly will. The only remedy we know of is for those who build the best tools to push them, and get the trade which by right belongs to them. Some are doing this and are not only making money by it now, but are building up a reputation abroad which will have substantial value in the future.

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At this writing, a court of inquiry is considering the failure of the monitor "Puritan" to make the run from Charleston to New York under her own steam. The cause of the failure is understood to have been with the engines, and naturally the consideration of the matter will be largely of a technical nature. The court, however, is composed of four line officers and only one engineer. It is understood that engineers expressed themselves as dissatisfied with the performance of the engines at the dock trial, and stated that they were not fit for service at sea.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(38) J. B. H., Washington, Ind., writes: I am employed in a general repair shop, and had occasion recently to put a brass lining in a pump cylinder 10 x 18 inches. The lining was ⅜ inch thick after being turned to size. Not having a press in the shop, and knowing the lining was apt to buckle in driving it, I concluded to heat the cylinder and secure the lining by shrinkage. When the cylinder had been heated, the lining dropped in very nicely, but after all was cooled the lining was found to be 1-64 inch loose. The foreman and myself had quite a discussion as to the probable cause of shrinkage, and we would like to know what you think of it. A.—Not knowing quite all the conditions, our answer to this question must be somewhat in the nature of a guess, and our guess is that the body of the cylinder, being very much heavier than the brass lining, contained sufficient heat to heat the lining to a pretty high temperature before it was itself cooled very much. This heat in the lining caused it to enlarge, and the coefficient of expansion for brass being greater than that of iron, it expanded rapidly, and, by the pressure thus brought upon it while hot, was to a certain extent crushed or compressed. Then, as the cooling process proceeded, the brass shrinking more than the iron by reason of its greater coefficient of expansion, the shrinkage in the former continued until it was as much smaller than its former size as was due to the crushing effect referred to.

(39) C. L. writes: I had an order to make for another man some ⅜ 28 dies and taps, "American standard thread." I made my master tap .375 inch, but cut down the thread one-tenth of the pitch, according to American standard thread. The party for whom these taps were made said that they were not ⅜; that they should have been made .375 inch, and then chase the thread to a sharp point, afterwards turning off one-tenth of the pitch, according to American standard thread. He said that the tap would then be ⅜ inch, American standard. It seems to me that if that were right, we would have to cut down the bolt, which is supposed to be .375 inch in diameter, to a diameter of .369 inch, and that the bolt would then centainly not be ⅜ inch. Please say who is right about this. A.—The only standard thread of any kind that we know of is one which, when finished, measures to correspond to its nominal diameter; that is to say, a ⅜ standard bolt or screw should measure .375 inch after it is finished, though, of course, slight allowances are made here and there for variations of fit, wear of taps, etc. The United States standard ⅜ bolt has 16 threads to the inch, and if made with 28 threads, or any number other than 16, then it is not standard, though it may have threads corresponding to the standard in shape and proportion. It is not right, however, to flat the threads one-tenth of the pitch; it should be one-eighth of the pitch.

(40) W. T. C., Chicago, Ill., writes: 1. What is the correct way to set a thread tool for a taper tap? A.—Set it the same as for any other job of screw cutting, except that it should be set at right angles to the center line of the tap to be cut, instead of at right angles to the surface of the work. 2. What is the difference between cutting a common taper tap and a clearance tap for the clearance of dies? A.—Hobs for hobbing dies with clearance are usually tapered the reverse way from taper taps in order to make the dies slightly larger at the rear. Your other question can best be answered by the firm you mention.

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American vs. Foreign Machines.

Editor American Machinist:

In commenting in your issue of March 4th, on an interview with Herr von Meyenburg on American machine tools, you have made some very fair and sensible remarks. Since, however, in the same issue you have done me the honor of devoting your whole editorial page to a reply to a letter that I recently wrote to the "Worcester Gazette" on the same subject, you will permit me a few words of rejoinder. As you have quoted only here and there from my letter, you have given occasion for somewhat misleading inferences, and have represented me by implication, as looking down upon American machinists in general. I took particular pains to state that I was fully aware that there were a large number of excellent workmen in the Worcester shops, my statement that seems to have caused trouble being that there were not five *first-class* mechanics. Perhaps I ought to have used italics before. I still maintain that the exercise of the highest skill is not found in building engines, lathes, or large machinery, but in that branch known to the Germans as "Fein-Mechanik," which for want of a suitable English term, I am obliged to refer to as instrument-making. Whether this is so or not, you can perhaps settle for yourself by your available information regarding the relative wages paid to workmen, for instance in the Brown & Sharpe shops and in any of the large Worcester shops. You will correct me if I am wrong in saying that there is not published in this country a single journal devoted to this "Fein-Mechanik." If there is any occupying a similar field to that of the "Zeitschrift für Instrumentenkunde," I shall be glad to be informed, that I may immediately subscribe for it. I may perhaps be permitted to say, however, that my former mechanician, observing how frequently I made use of the above journal, and how many ideas regarding shop practice were to be found therein, bemoaned to me his inability to read German, and the lack of anything in English where he could get the same sort of information. I am in like manner ignorant of works on instrument-building in English, and should be glad to be informed of their existence. The books that I have usually seen in the hands of mechanics are either cheap compendia of commonplace information, such as how to find the circumference of a circle of given diameter, absurd definitions, or random "wrinkles and recipes."

With regard to your statement with regard to plan specula, nobody admires more highly than I, the superb optical work of Brashear, plenty of which is to be found in my own laboratory, but it is only fair to say that what gives the diffraction gratings their value (for I take it that they are what you mean), is not so much the work of Brashear as the fact that they are ruled by means of the screw constructed by Professor Rowland, admittedly the most accurate in existence. As I said in my letter, Rowland is not an engineer, but a professor of physics. Brashear also was glad to go abroad for study, if I am not mistaken.

Your statement that the successful manufacture of standard gages was first carried out in this country I cannot gainsay, but there comes to my mind the name of Sir Joseph Whitworth, and I will leave the question to you and the English journals. As for American-made dividing engines, I am not quite prepared to admit that they are "the peers of those manufactured anywhere," with the exception of Professor Rowland's, already mentioned. If you will mention two American firms (without German names), manufacturing first-class dividing engines, I will undertake to mention twenty foreign ones.

It is true that the Lick and Yerkes telescope-mountings were made by Warner & Swasey, as the Niagara turbines were built by I. P. Norris, but Professor Hale wisely traveled all over Europe, visiting

every telescope of large size before he made the designs, as I presume the designer of the Lick mounting did. To bring Alvan Clark into a discussion of mechanical work is rather beside the mark. Very little of the work on the Clark lenses is done by machinery, all the final work being by hand. As for microscopes, the finest lenses by Bausch and Lomb are made under the patents of Zeiss, of Jena.

In taxing me with being unfortunate in my illustrations, you seem to have curiously missed my point. In the list I gave of "American" firms, including Fauth, Saegmüller, Kandler & Gaertner, Bausch & Lomb, Grunow, Buff & Berger, etc., I did not think it necessary to point out that these were all German names, although, of course, that was the point in thus collecting them. You may reply that these gentlemen are all Americans by adoption—if so, I am glad of it. If this list is unfortunate for my contention, I fail to see it.

No one admires more than I do an ingenious piece of machinery, such as we produce in such great numbers in this country, whether it is a self-binding reaper, a screw-machine, or one of these wonderful shoe-machines which have driven shoemakers out of existence. But we must remember that it is precisely the development of machine tools which, to a large extent, is responsible for the lack of first-class workmen which I have deplored.

I trust that I may include myself among those "who know how akin are the methods of thought and mental dexterity employed" in mathematics and in mechanical invention, and I also know that there is no mystery about either, but that thorough preparation and study is needed in both cases. Only a few days ago a not particularly intelligent visitor to my laboratory said to me with great solemnity: "I understand that you gentlemen *invent* a great part of the apparatus that you use. Isn't it wonderful!" I replied that I did not think it wonderful at all, as that was our business, and that all research consisted chiefly of invention. As we do not patent and sell our inventions, however, editors of technical journals consider us of little account, and treat us with such complimentary language as you use in your concluding paragraph.

I have already trespassed too long upon your space, but permit me, in closing, to emphatically deny that it is "a part of the mental habit of the school atmosphere to see no merit in the solution of a problem unless it is shrouded in mathematics." The simpler a solution, the better. I am not one of those teachers who will have nothing of geometry when they can use analysis, nor are there many such. The statement that you make is a favorite belief of the practical man, who delights in poking fun at the supposedly cut-and-dried professor. A little more intimate knowledge of professors might do him good. To the accusation of a belief that, in teaching, methods are more important than results, I plead guilty. I believe that a head full of brains is worth more that any number of engineer's pocket-books, and that a knowledge of how to attack all sorts of problems is superior to a familiarity with a lot of particular cases. As an instance of what I mean, we have now on the market a large number of books about alternating currents. Most of these are distressingly tedious reading, consisting of a multitude of cases worked out with painful iteration, while the methods for solving them all, and many others besides, might be taught in a few pages. This is an illustration of your statement, with which I unreservedly agree, that "there is too much of the narrow-vision, close-view method followed in teaching mathematics, and although too little of that broadly comprehensive method which makes the philosophy of the subject of the first importance." Teach your engineering professors that, and you will have accomplished something useful.

ARTHUR GORDON WEBSTER,
Clark University.

Worcester, Mass.

[If we in any way failed to fairly represent Professor Webster's position, it was certainly unintentional. We could not well reproduce his entire letter to the "Worcester Gazette," and we well know how unsatisfactory a few extracts sometimes are. Still we fail to see how those made do not represent his statements fairly.

The professor clings to the idea that instrument-making is the final test of excellence in mechanical work. This we deny. The difference is radical, and discussion cannot affect it. We therefore think that Professor Webster and ourselves will have to agree to disagree.

There are, however, a few points and matters of fact on which an additional word may be worth saying.

We made no reference to Professor Webster's list of German American firms, but to his illustrations of the fields of work in which he stated or implied that American mechanics occupy an inferior position, and we considered him to be unfortunate in these illustrations because—successfully, as we think—we showed that the very line of products to which he referred, had in many instances been pushed to their highest degree of excellence here, and chiefly by houses which do not carry German names either. Since our editorial was written, we have learned of the shipment to Germany, by Mr. Brashear, of the largest and most powerful spectroscope yet made, and the third supplied by the same maker to foreign observatories.

We yield to no one in our admiration for the work of Sir Joseph Whitworth, who was in many respects the greatest mechanician of his time, being the first to appreciate and in some directions introduce really accurate workmanship. His gages were a distinct advance in the mechanical art, and did much to create a new standard of workmanship—one, in fact, which they could not themselves satisfy. Professor Webster seems not to be aware that these gages did not agree among themselves. This, however, is well known, as is also the further fact that gages which did satisfy this test were first made here.

We are unable to read Professor Webster's reference to the Lick and Yerkes telescopes in any other way than as implying that the relationship of Warner & Swasey to them was the same as, or similar to that of the I. P. Morris Company to the Niagara turbines—that of builders only. We did not understand this to be the case, and consequently wrote to Messrs. Warner & Swasey on the subject, and their reply will be found in another column. We do not imagine that in this they would be understood as claiming that these telescopes were in all features absolutely novel, the essential features of an equatorial mounting being fixed by the structure of the solar system; nor do we suppose that European experience and practice were ignored in the construction, as sensible men of this day and age do not undertake such work in that way. The telescopes were, however, in design as in construction, as distinctly the products of their builders, as any machine not an absolute new-comer can well be.

We are unable to understand how Alvan Clark's work can be considered "beside the mark," because of "all the final work being done by hand." We supposed this discussion related to mechanical skill, of which there can, perhaps, be no better illustration than the grinding of lenses.

In the matter of dividing engines, we have the word of Mr. Brashear, regarding the new Warner & Swasey machine, which our correspondent will probably not gainsay, that "it is more accurate than any heretofore constructed."

So far as the opinion expressed of the bent of mind common to many professors is concerned, the writer of the editorial and of this reply, thinks he knows something about it. He certainly sat under their instruction long enough to find out.

It is a source of gratification that Professor Webster and ourselves can agree upon at least one point—the teaching of mathematics. Extremes meet!—Ed.]

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The Design of the Lick and Yerkes Telescopes—Foreign Copies of American Tools.

Editor American Machinist:

We have your esteemed favor referring to the critisism of American mechanics by Professor Webster, of Clark University, and asking us for facts as to who is responsible for the designs for the large

telescopes which have been constructed by us.

We have always been given the credit for designing these instruments—the question having never before been raised—but, as we are somewhat rusty on the subject, we have looked up the correspondence so as to refresh our memory.

In 1886 we received a letter from Captain Floyd, president of the Lick trustees, in which he states:

"The Lick trustees respectfully invite the following firms to prepare and submit plans, specifications and estimates for the mounting of the 36-inch telescope:

1. Alvan Clark & Sons, Cambridgeport, Mass.
2. Warner & Swasey, Cleveland, O.
3. Repsold & Sons, Hamburg, Germany.
4. Howard Grubb, Dublin, Ireland.

These plans will then be considered by the trustees, and a final plan determined upon, and accurate specifications and drawings will be prepared, or else one of the plans submitted may be at once accepted."

Our firm accepted the invitation to prepare specifications, plans and estimates, and, strange as it may seem, the trustees, after careful study of all the plans submitted, accepted at once our plans and specifications, and awarded the contract to us, and we constructed the telescope on these lines.

For the mounting of the 26-inch telescope for the new Naval Observatory, Washington, D. C., general specifications, but no drawings, were gotten up by the Department, these specifications being embodied in an advertisement in the usual form. The design and drawings which we submitted for this telescope were never seen by outside parties until they were all completed and formally opened at the Department in Washington. We were awarded the contract, and made the telescope in accordance with the drawings submitted by us.

We will mention but one other, namely, the Yerkes telescope—the largest in the world—and need only state that specifications and drawings were prepared and submitted by us to Mr. Yerkes, who at once accepted them without alterations, and awarded the contract to us.

Our telescope designs and construction showing such a marked departure from the common type of instruments, naturally aroused severe criticisms, which, however, soon turned to compliment, for the catalog of the largest importer of foreign instruments in this country illustrated, as foreign, one of our telescopes, and the late catalog of a large manufacturer of instruments in Berlin illustrates as his own, a 9-inch telescope which is an exact reproduction, line for line, of the wood-cut of our 9-inch telescope, which we published several years ago.

American leadership in mechanical lines is not confined to scientific instruments, for the three largest armories in Germany—those at Erfurt, Danzig and Spandau—are fully equipped with machinery and tools made by the Pratt & Whitney Company; in fact, the work of American mechanics is so thoroughly appreciated in Europe, that the business of many large firms is devoted wholly to the reproduction of the best American machine tools.

In the summer of 1896 the writer visited two European exhibitions, one in Berlin and one in Nijni Novgorod, Russia. In the Berlin Exhibition he saw a large exhibit of Pratt & Whitney and Brown & Sharpe machine tools, which made him feel quite at home, but which, on close examination, proved to be copies made in Berlin. A little further on, an exhibit looked even more familiar, for it was made up of our own machines, but a closer view showed that another name was cast on the machines, for they, too, were made in Berlin.

In the Nijni Novgorod Exposition was a splendid exhibit of Worthington pumps, ranging from the smallest to very large ones; but, alas! they were made in Moscow, and were selling in competition with the genuine Worthington pumps; agencies for which are established in the leading cities all over Europe. Not far from the pump exhibit was shown a few splendid Pratt & Whitney machine tools, but the name of the Hartford Company was not on them, for, while every line and every screw was like the original, they were made in Russia.

We believe that Professor Webster is honest in his criticism, but presume that he has given more study to foreign manufacturers than to the products of our home shops. We have, therefore, extended to him an urgent invitation to visit our works, and hope other American manufacturers will do the same.

WARNER & SWASEY.

Cleveland, O.

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Steel Sparks—Marking Bar Steel.

"Sparks from the Crescent Anvil," which has not appeared of late on account of the ill health and continued absence of its editor, has made its appearance again. It contains many practical and pointed suggestions to the users and workers of steel. It specially notices Mr. Morris Fulton's letter on "Intelligent Co-operation in the Use of Steel," which appeared in our second issue of this year, and in which the writer suggested that the carbon percentage should be stamped upon each bar of steel. It remarks thereupon as follows:

"While agreeing with Mr. Fulton's suggestion in the main, 'Sparks' is of the opinion that it is better to stamp in the bar a statement of the 'temper,' which is made up of a determination of all the hardening elements in the steel, rather than confine the stamping to a mere statement of the amount of carbon.

"For thirty years and more it has been the constant practice of the Crescent Steel Company to stamp a letter in two places near the middle of each bar. The letter stands for a temper. The Company furnishes buyers with a card on which the letters are printed in connection with the purpose or purposes for which each of such tempers is recommended.

"Armed with such a card, the steel user has no difficulty in selecting from his rack a bar of steel exactly suited to any intended purpose."

We append a few additional extracts:

"Steel of different hardening properties does not show the same degree of hardness when drawn to the same temper color. Color is not, therefore, a sure guide to the temper.

* * * * *

"For hardening heavy lathe and planer tools for hard work, when the steel has been selected at random and is found a little too low in hardening properties for the purpose, take one pail soft water, one-quarter pound cyanide of potassium, one pound salt, one dessert spoonful oil of vitriol. Draw the temper slightly. This is Hunt's Tempering Recipe.

* * * * *

"Fish oil (bank oil) bites best in tempering springs. Fish oil will give sharper temper than cotton seed or black oil. The heat for tempering in fish oil may therefore be a shade less and the springs will stand up better.

* * * * *

Large centers in taps and reamers are a cause of cracks; close them up.

* * * * *

"Frank.—We return the tap, turned and hardened. There appear to be three faults: 1st.—You annealed the steel too much and consequently it does not hold its temper as it should; 2d.—It was turned with a dull tool; 3d.—The tool seems to have been set below the center. The second and third defects caused the roughness which the steel shows, but, with a sharp tool properly set in our lathe, it cut nice and smooth. If the treatment of steel is the study of a lifetime, you need not be discouraged by an error now and then. The steel worker does not live who never spoiled a piece of steel."

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Technical Books.

METALLURGY OF CAST IRON. By Thos. D. West. Cleveland Printing & Publishing Company, Cleveland, O. 573 4½ x 7½-inch pages; 106 illustrations. Cloth; $3.

This is a book which it is somewhat difficult for a reviewer to do full justice by. It is written by a practical foundryman who knows a great deal about practical foundry operations, and is the author of books on that subject which are justly regarded as authorities. The present book contains much that is of value; in fact, all that portion of it which is a record of the author's observation and experience in conducting a foundry has value, but unfortunately he has incorporated in the book a good deal of what might be called

theorizing, and nearly if not quite all of this is valueless. Not only this, but in a number of instances the author shows clearly that he has no conception whatever of the principles applying to the phenomena he discusses. Merely as an illustration of what we mean, and without attempting to go into details in every case, we may note his treatment of the transverse strength of test specimens of cast iron. He evidently considers it to be right to simply note the load at which a specimen breaks in a transverse test, divide this load by the area of the specimen in square inches, and call that the "strength per square inch"; and he actually gives in the same table such figures of "strength per square inch" of bars ½ inch square, and for others 1 inch square, 1⅛ inches square, and for round bars 1⅛ inches diameter. Of course, he obtains ridiculous results, and shows only that the science of the strength of beams is to him a sealed book. This of itself would not be so bad, but that an author so absolutely devoid of all knowledge of that science should attempt to demolish it, and to criticise the work of those who do understand it, is certainly a very bold undertaking, to state the case mildly. If this book could have been edited by someone familiar with the subjects of which it treats, it would have been smaller, but much better.

STEAM BOILERS. By C. H. Peabody and E. F. Miller. 380 6 x 9-inch pages, 140 illustrations and 5 folding plates. Wiley & Sons. Price $4.

Boilers are a very prolific subject for book making, judging by the number of books on that topic that come from the press. In the nature of things, not much that is new can be expected at this late date on such a subject. At the same time this book is a good one, and well adapted to the needs of the majority of purchasers. It deals distinctly with modern boilers and with commercial types, giving the proportions, arrangements, accessories and settings that are to be seen in power plants all around us, and does not assume that when the subject of heat transfer has been expounded, the subject of boiler design and construction is exhausted. It puts the reader in touch with the practice on most branches of the subject, and in the chapter on boiler design, goes through the actual process followed in planning a boiler—not hesitating to give the actual numerical steps of the process. The authors have not hestitated to use mathematical symbols, but the work of this kind is simple, and will not embarrass anyone possessing a rudimentary knowledge of the use of algebraic signs. The folding plates give working drawings of various types of boilers and of two types of chimneys.

BEARINGS AND LUBRICATION. A Handbook for Every User of Machinery. By A. J. Wallis Tayler. 208 4½ x 7-inch pages, with 75 illustrations. D. Van Nostrand Company. Price $1 50.

A useful and complete résumé of the present stock of knowledge of the many kinds of lubricants used, and of the practice in applying them. All standard forms and systems of lubricators are described. The book is of English origin, but contains many references to American practice and innovations.

THE TUTORIAL STATICS. By William Briggs and G. H. Bryan. 260 4¼ x 6¾-inch pages, with 189 illustrations. Hinds & Noble. Price $1.

This is one of an extensive series of English books covering a great variety of subjects. The present volume covers the action of forces at rest. The subject is well and compactly presented, and with a minimum of mathematics—a knowledge of algebra and plain trigonometry being all that is required to read the book. Each section concludes with a series of examination questions, as is customary in English books intended for students who are preparing for "the examinations"—whatever that may mean. We know of no better or simpler presentation of such subjects as the composition of forces, the properties of the mechanical powers, work and friction.

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We learn there is to be a Trans-Mississippi and International Exposition to be held at Omaha next year, and that a number of railroads have made donations to it, and that Congress has appropriated $200-000 to defray the expenses of a national exhibit. It is stated that the government will erect a great building for its exhibit. The above, with a lot of other information, comes from the "Exposition Press Bureau," of Omaha, and, so far as we can learn, all this progress, including an appropriation by the government, has been made without previously attracting any attention to speak of.

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It is announced in "Stahl und Eisen" that European metallurgists, including the director of the Swedish Government testing laboratories at Copenhagen, are proposing to repeat Mr. Outerbridge's experiments, an account of which we published last year, and which showed that iron castings were decidedly strengenthed by being tumbled or rattled, contrary to the previously cherished opinion. It has been shown by Professor Bach and others that removing the skin of cast iron, by planing or otherwise, increases its strength from 11 to 20 per cent. by removing more or less the strains caused by irregular or unequal casting. The operation of the tumbling process is thought to be similar.

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The long-distance electrical transmission at Fresno, Cal., which was described in our recent article showing what had been accomplished in that line of work, has been heard from, after having been in operation for several months. The president of the company states that "the 35-mile transmission has given us no trouble whatever. Our load at present consists of 145 arc lights, 5,000 incandescent lights and 410 horse-power of motors, the latter including 180 horse-power for the Sperry Flour Mill and 75 horse-power for the city pumping plant. All of the machinery doing this work has worked with perfect success from the start. The incandescent lights have most of them been newly wired in, thus enabling us to properly balance the load, and the regulation has given us no trouble whatever. During extensive tests, it was impossible to find more than two volts variation between any lamps on the system. Lights so furnished seem to me to be better than incandescent lights usually furnished in San Francisco and other cities of the State."

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Those English Keys.

Editor American Machinist:

In your issue of March 4th you publish from London "Engineering," under the head of "A New Key," some statements that are erroneous. The key described I have used myself for twenty-five years, and, having called the matter to the attention of my father, I ascertained that he used it for shafting purposes on the Great Lakes as long ago as 1842. It is the best key to use where a minimum weight is an object, and it is very successfully used at present in the noted flying machine experiments of Professor Langley, of the Smithsonian Institute. I have used it many cases where a wheel has been too large for a shaft, when, by using three keys, the wheel can be trued, and I do not remember a ingle instance of the wheel working loose.

Washington, D. C. L. C. MALTBY.

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At a recent trial at Shoeburyness of an armor-piercing shell, fired from a 12-inch wire wound gun, the shot completely penetrated an 18-inch steel-faced compound armor plate, a 6-inch wrought iron plate, 8 feet of solid oak and about 3 inches of iron behind that, and was then embedded in a clay bank 35 yards in the rear.

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It is formally announced that the spring meeting of the American Society of Mechanical Engineers will be held at Hartford, Conn., during the week May 24th to 29th.

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Personal.

Mr. E. P. Bullard, of Bridgeport, Conn., sailed yesterday by the "St. Louis" for Europe on a business trip.

Mr. W. A. Warman has taken charge of the works of the Buffalo Metal Manufacturing Company, Buffalo, N. Y., and Mr. Thos. A. Dicks is with the Spaulding Machine Screw Company, of Buffalo, N.Y.

Passed Assistant Engineer J. C. Leonard, U. S. N., will go from the "Detroit" to the "Cincinnati," in the Mediterranean, and Assistant Engineer E. R. Pollock will go from the "Cincinnati" to the "Minneapolis."

Commercial Review.

NEW YORK, SATURDAY EVENING, MARCH 20TH.

THE LIBERTY STREET MACHINE TOOL TRADE.

We have arrived at another of the four-weekly stopping place where, according to custom, it is incumbent upon us to take the bearings of the iron-working machinery business. The winter has been a conservative one, as is acknowledged by all the general machine tool sellers in this city, so far as we are aware, and the approach of spring has had little or no effect in stirring the funereal atmosphere of Liberty street and its environs.

Just at the present time it does seem, however, according to several reports, as though there were a little tendency toward better business. Not much in the way of new enterprises is being done, and orders of any size are infrequent, but a little more demand is reaching some concerns, from established shops who are buying a machine here and there to add to their plants.

"People will buy if they can find bargains," remarks the head of one house of good standing, who, it may be said, has purchased a stock of second-hand tools in another city and is meeting with fair success in disposing of them. "If people buy second-hand tools, there will, after a while, be a market for new ones."

The personnel of Liberty street business is undergoing a few changes, and competition will perhaps be sharpened by the establishment of one or two new stores. One of these has been started during the winter, to sell the tools of the Gisholt Machinery Company and others. Another is the Cooke Machinery Company, just around the corner, on Washington street, who will devote themselves more especially to machinery than did their predecessors. The Sterling Machine Tool Company, controlled by Mr. H. F. Frevert, has bought out the Davis-Egan agency. The office of the Bullard Machine Tool Company has removed to No. 120 Liberty street.

Landis Bros., Waynesboro, Pa., manufacturers of grinding machines, etc., send us a report of good business. It shows that a fair part of the trade is domestic, though, indeed, it would be a more favorable sign of business conditions if the proportion were greater. Their view of the outlook is exceptionally encouraging. They say: "Recently we have received many more orders than in any like period during the last three years, having made shipments of two machines to Chicago, one to Springfield, Ill., one to New York, two to London, one to Germany and one to the Brussels exposition; also, two of our largest size are under way for Antwerp. Prospects are good for increased business, and the number of inquiries is larger than at any time in '96."

(Continued on page 38.)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced draftsman wants position. Box 129, AMERICAN MACHINIST.

Draftsman, mech., desires pos., exp. gen. mach.; South preferred. Box 137, AMERICAN MACHINIST.

A good, practical draftsman seeks position; 12 yrs. experience in shops and offices Box 138, AM. MACH.

Expt. mechl. engnr., wide prac. exp., wishes pos. as ast. supt. or dsgr. Best refs. Box 132, AM. MACH.

Pos. wntd. in mach. shop or dftng. room by tech. grad., with expnce. in both. Box. 134, AM. MACH.

Position wanted by experienced foundry foreman; no choice of work or location. Address Box 139, AMERICAN MACHINIST.

Experienced supt. on Corliss engines, hoisting, mining, ice making and genl. heavy machy. open for engmt. as supt. or salesman. Box 136, AM. MACH.

Wanted by a thorough prac. mech., die sinker and tool maker, pos. as asst. supt. or foreman; good manager of help and a hustler. Box 125, AM. MACH.

Open for engmnt. after April 1, a mach. shop supt. or foreman, familiar with high grade and accurate work; eng. work preferred; 10 years experience. A1 reference. Box 135, AMERICAN MACH.

A middle aged mech. eng. with extensive exp. at designing light machy. and tools and familiar with the mfr. of tinware and hardware wishes to make a change. Box 126, AMERICAN MACHINIST.

Machinist, general foreman of heavy engine works, wants similar position, in shop that is run to make money; or to go on the road setting up engines. Address Box 122, AMERICAN MACHINIST.

Double entry bookkeeper, stenographer or traveling-salesman desires pos. Can furnish first class recomdtns. as having served in above capacities. Nine years office exp. Address Clerical, AM. MACH.

A skilled designer and builder of special machy. is open for engagement; many yrs. exp in originating and perfecting automatic machy. and improving mfg. processes; highest ref., covering entire record. Address Box 65, AMER. MACHINIST.

Wanted—Situation as superintendent or assistant of mfng. co., by prac. mech. and manager, experienced in mach. shop, fdy, blacksmithing and woodworking work, and accustomed to handling men and work to best advantage. Box 140, AM. MACH.

Help Wanted.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Wanted—First class slotting machine hands. State experience and wages required. Apply Canadian General Electric Co., Peterboro, Ont.

Wanted—A first-class man to work on instruments, tools, dies and milling cutters; steady work. Address P. O. Box 370, Salt Lake City, Utah.

Wanted—Good all-around mechanic as machinist and pattern maker. Good position for the right man. Address, M. P., AMERICAN MACHINIST.

Wanted—An experienced foreman in assembling department of bicycle factory. State wages and experience. Address Box 133, care AMER. MACH.

Engineers out of employment can make good com by selling our new book The Practical Man. of Engines and Boilers. $2. Phila. Book Co., Phila., Pa

Wanted—Number one foundry foreman, who understands melting iron and best way of getting out castings, modern shop. Pig Iron, AM. MACH.

Wanted—Engineer for 400 H.P. Corliss type eng., Westinghouse 150 H.P. eng., 50 H.P. upright eng. Cmpsn. pumps, etc. Must be first-class machinist, sober and steady. Will be provided with ast. and fireman. Write, giving recommendation, wages expd., age and nationality, to Manufacturer, care AMERICAN MACHINIST.

Wanted—A first class, sober, reliable fie'd foreman, to build tanks, smoke stacks, water towers, etc. Must be capable of estimating costs on field work and keeping his labor within estimate. Would be located in New York and used in that city and surrounding territory. Address, stating experience, etc., Field Work, care AM. MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Draftsmen's new conveniencies. D. J. Kelsey, New Haven, Conn.

For sale, 5 H.P. Hartig gas engine, nearly new. J. A. Martin, 58 Centre Street, New York.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Models, experimental and small special machy. built. Write to Crocker & Lawson, Binghamton, N. Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

Will exchange new 2 H.P. Acme coal oil engine for good lathe. Address Morse Machine Co., Rochester, N. Y.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 7 of this edition.

Wanted—Thorough mechanic with $1,000 or $2,000 as partner. Must have good reference. Business located in N. Y. city. Box 131, AMER. MACHINIST.

Model locomotives—complete castings, latest N. Y. Cen. stnd., right up to date.; 4c. in stamps for catalog. G. H. Olney, 163 Herkimer St., Brooklyn, N. Y.

For Sale—Garvin No 2 screw mach, wire fd., tools, fixtures, chuck: also B. & S. No. 2 U.M. mach., large stock cutters, mach. new, Jan. Box 130, AM. MACH.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Business Opening—Foundry and machine business in East Tenn. A rare optnty. for a bus. man, machinist or molder wishing to go south; only bus. of kind in growing mfg. city of over 4,000 population; reason for selling wish to engage in another line of bus. For further particulars ad. Box 101, Harriman, Tenn.

Are you an all-around machinist, or have you a friend that is? I have one of the best locations for a man to be found in the State or States. A sure success for right man. Shops tools and all kinds of machinery all in first class running order. Parties must have about $1,500 cash or its equivalent. Will give all the time wanted on balance. Will sell shops, or lease. Here is your chance if you wish to live a prosperous life. Address Martin Hamm, Strasburg, Ill.

VALUABLE BOOKS

For MACHINISTS, ENGINEERS and STUDENTS.

GAS, GASOLINE AND OIL ENGINES.

By GARDINER D. HISCOX, M. E.

A book designed for the general information of every one interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer.

Price, $2.50.

STEAM ENGINE CATECHISM.

By ROBERT GRIMSHAW, M. E.

Tenth Edition. 413 Pages. Fully Illustrated.

Price, $2.00.

ENGINE RUNNERS' CATECHISM.

By ROBERT GRIMSHAW, M. E.

Second Edition. 336 Pages. Fully Illustrated.

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Nearly 400 Pages. 222 Engravings.

Price, $2.50.

, Any of the above books sent free on receipt of price. Our large Catalogues embracing works on every practical subject, also a special circular of any of the above books, mailed free, on application.

NORMAN W. HENLEY & CO., Publishers,

15 Beekman Street, NEW YORK.

(Continued from page 37.)

THE EXPORT MARKET.

A gentleman who travelled in Europe last year as representative of a large local machinery concern, has just exhibited to us some proofs of the fact that American tools are being copied in Europe, in the shape of catalogs showing illustrations of both metal and wood-working tools, manifestly designed according to American models. He stated that in Berlin he had found that tools of the Brown & Sharpe Manufacturing Company, and also Hartford automatic screw machines, were being imitated. At Leipsic the same sincerest flattery was paid to the Detrick & Harvey open side planer, and the lathes and radial drills of another American manufacturer. That the excessive demand for machine tools abroad has been an important factor in the trade which has made its way to this country, finds an illustration in a case spoken of by our informant, where a Berlin arms, machine tool and electrical establishment placed a considerable order in the United States for tools to go to an arms factory in China. He thinks that the higher tariff system of France, than that of some other countries, retards the sale of American machinery in that country, and says that, at the time he was in Europe, the subject of an increase in French duties was under consideration.

Our contemporary in the city of Mexico, "The Two Republics," is offering to furnish gratuitous information as to the resources, advantages and opportunities offered by Mexico for investment purposes. Possibly the offer might be of assistance to some of our readers who desire to enter into closer trade relations with that country.

United States Consul H. A. Johnson, at Venice, writes that there is a good prospect for the bicycle export trade with Italy, and recommends that the following machines be constructed for that market: A showy wheel to retail for not more than $115.80; a good, well-finished, but somewhat less elaborate machine for not less than $86.85; and a simple but strong wheel for $57.90. He advocates the establishment of a shop in Northern Italy for putting together the component parts of the bicycles, in order that the expense of the duties may be lessened by their shipment unmounted.

The following are a few indications of business that may be obtainable from the United States of Colombia: Cisceros & Co., who control the street railway at Barranquilla, propose to extend it six miles, and are expected to require some new material and equipments. Some export houses have received inquiries from Bogota for candle and soap-making machinery, and from elsewhere in the same country for machinery to be used in the manufacture of brick.

The United States Treasury Depart-

(Continued on page 39.)

Columbia University
in the City of New York.

SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
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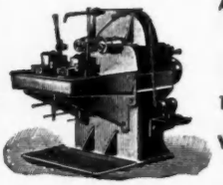

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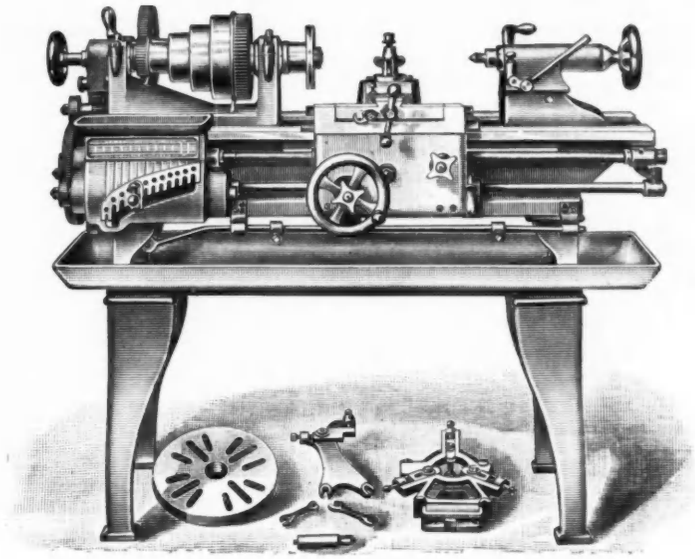

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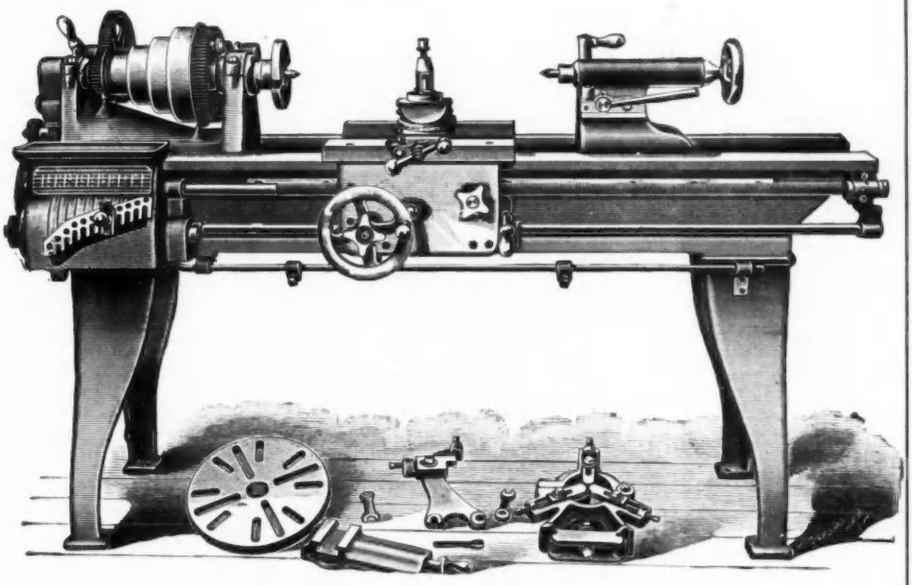

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(Continued from page 38.)

ment's Monthly Summary of Finance and Commerce for January, 1897, shows that the total exports of machinery of all kinds (among domestic merchandise) amounted to $2,328,201, against $1,627,490 for January, 1896. The figures for December, 1896, were $2,654,394. So the maximum has already been passed. For the seven months ending January, 1897, the total is $16,536,709, as compared with $11,680,728 for the corresponding seven months a year ago. The value of the exports for January, 1897, of cycles and parts of cycles, was $480,092, against $89,182 for January, 1896, and $387,410 for December, 1896. Cycles are not classified under the heading of machinery.

Quotations.

NEW YORK, Monday, March 22.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $12 50
No. 2 foundry, Northern	11 50 @ 11 75
No. 2 plain, Northern	10 50 @ 10 75
Gray Forge	10 50 @ 11 00
No. 1 foundry, Southern	11 50 @ 12 00
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, or No. 4 Southern	10 25 @ 10 50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.25c. Store prices: Common, 1.35 @ 1.50c.; refined, 1.45 @ 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.60 @ 1.65c.

Cold Rolled Steel Shafting—Base size, 2.50 @ 2.55, in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 11¾ @ 11¾c.; electrolytic, 11¼ @ 11½c.; casting copper, 11⅛ @ 11¼c.

Pig Lead—In carload lots, 3.45 @ 3.50c., f. o. b.

Pig Tin—For 5 and 10-ton lots, 13.50c., f.o.b.

Spelter—In carload lots, New York delivery, 4.15 @ 4.20c., f. o. b.

Antimony—Cookson's, 7½c.; Hallett's, 6¾ @ 7c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 39 @ 41c.

▲ ▲ ▲

Manufactures.

At Sharon, Pa., Shefler Bros. will erect a tin-plate mill.

George C. Moore, Lowell, Mass., will enlarge his woolen mill.

Rand & Harvey, of Lewiston, Me., will erect a new machine shop.

Messrs. Cole & McEwen, Le Roy, N. Y., will erect a new mill.

William Scholes & Sons, of Philadelphia, are to erect a new mill.

The Standard Oil Company will erect a refinery at Neodesha, Kan.

The Junction Iron Works will erect two tin mills at Mingo Junction, O.

The Savannah cotton mills, Savannah, Ga., will install new machinery.

The Falcon Iron & Nail Company, at Warren, O., will enlarge its plant.

The Buckeye Glass Works, recently destroyed by fire, will be rebuilt.

The Pacific Planing Mills, San Francisco, Cal., has been destroyed by fire.

The Sheboygan Knitting Company, of Grafton, Wis., will add to their plant.

A new sugar factory is to be erected at Salinas, Cal., by Claus Spreckles.

At Augusta, Ga., the Sibley Mill Company will make an addition to their plant.

At Cummins City, Wyo., the American Gold Company is erecting a smelting plant.

A fire visited the foundry of B. J. Romaine, Hackensack, N. J., destroying machinery.

At Benwood, W. Va., the Riverside Iron & Steel Company will erect a new plate mill.

The New York Carbon Company will remove from Newark, N. J., to Rahway, N. J.

The Condor Iron Foundry, East Boston, Mass., is constructing a new two-story building.

Captain John B. Ford is contemplating the erection of a soda factory at Wyandotte, Mich.

The Pennsylvania Bolt & Nut Company, Lebanon, Pa., are making an addition to their plant.

At Lewiston, Me., the Bath Torrey Roller Bushing Works will erect an addition to their plant.

The John P. King Company, at Augusta, Ga., will make extensive additions to its plant.

The Lancaster (Pa.) Electric Light, Heat & Power Company is to erect a power-house and station.

At Falmouth Foreside, Me., the power-house of the Yarmouth Electric Railroad will be erected.

Horace Kimball, of Nasonville, R. I., will rebuild the burned mill and put in new machinery.

The ... M. Whitney Manufacturing Company, St. Louis, Mo., will soon place new machinery.

The Norfolk Foundry & Manufacturing Company, Norfolk, Neb., will add new machine tools.

The Whitman Mills, of New Bedford, Mass., will increase its capital and make additions to its plant.

At Pueblo, Col., the Colorado Coal & Iron Company will soon commence the erection of a steel-rail mill.

The George V. Cresson Company, of Philadelphia, Pa., will have built a new machine shop, 40 x 130 feet.

The Labelle Iron & Steel Company, of Wheeling, W. Va., have decided to build another tin-plate mill.

The mill of W. L. Miller, Portland, Ore., was recently destroyed by fire, doing much damage to the machinery.

The Greenville Tube Company, of Greenville, Pa., and of which F. A. Ensworth is manager, has decided to enlarge its plant.

The L. I. Mill & Construction Company has been formed at Jamaica, L. I. Directors: John T. Hangaard and William O. Hangaard.

McIntosh, Seymour & Co., Auburn, N. Y., have commenced the work of extending their shops. A new blacksmith shop is also being built.

The Atlantic & Pacific Railroad, of which Mr. A. G. Wells is superintendent, will erect a new boiler shop and enlarge their plant at Albuquerque, N. M.

At Fostoria, O., the Fostoria Incandescent Lamp Company has been organized. Messrs. B. G. Tremaine, of Cleveland, and J. B. Crouse are interested.

The Davis & Egan Machine Tool Company, Cincinnati, O., have just opened a branch with the Cleveland Tool & Supply Company, 5 Long street, Cleveland, O.

The Manhattan Car Wheel Company has been incorporated in New York City, with P. Henry Griffin, T. Guilford, of Buffalo, N. Y., and John A. Granger, New York City, as directors.

The New York office of the Bullard Machine Tool Company, of Bridgeport, Conn., has been removed to 122 Liberty street, where it is in room No. 810. It remains in charge of Nicholas B. Lyons.

The Dickson Manufacturing Company, of Scranton, Pa., have commenced the construction of a new boiler shop, 130 feet wide and 225 feet long. This building will have a steel framework throughout. The sides will be covered with corrugated iron, and the roof with composition roofing on plank. The main boiler shop is about 52 feet wide and 45 feet high. Thirty feet above the ground is a runway made of substantial steel girders, which carry a 30-ton power traveling crane. At one end of the main shop is a riveting tower, 25 x 50 feet, having a runway carrying a 20-ton crane, 50 feet above the floor level. The crane in the riveting tower runs at right angles to the one in the main shop below. Adjoining the main shop is a punch-room, which is about 50 feet wide, extending the full length of the building. Attached to the roof trusses of this portion is a traveling crane of 5 tons capacity, which covers the whole floor surface. Adjoining the punch shop is a space for the flange fires and other furnaces, 25 feet wide and 225 feet long. All the main posts of the building are arranged so that jib cranes can be attached to them, and the trusses are arranged so that shafting and other machinery may be attached at convenient points. The steel work was designed and will be furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

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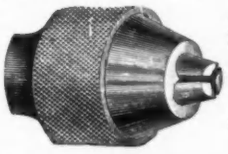
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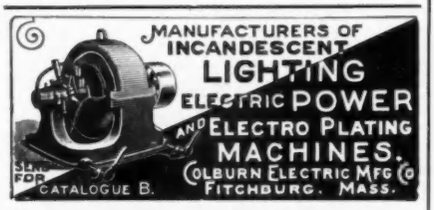

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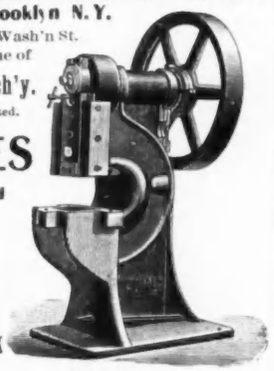
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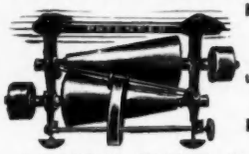

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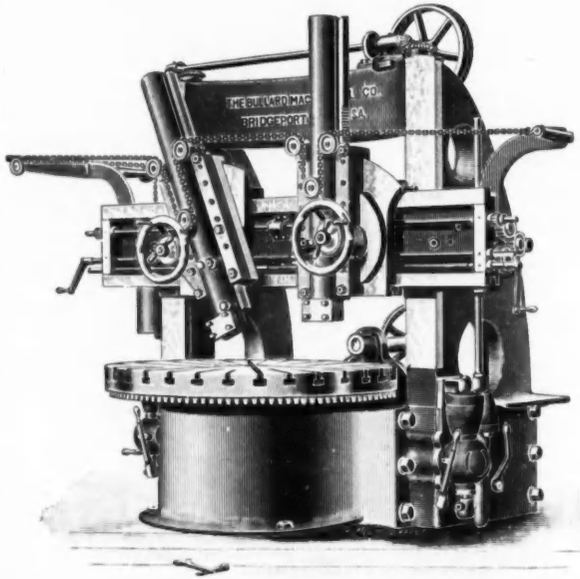

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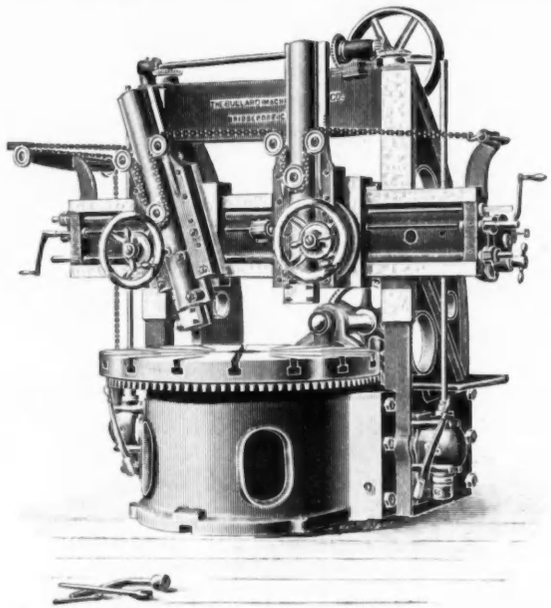
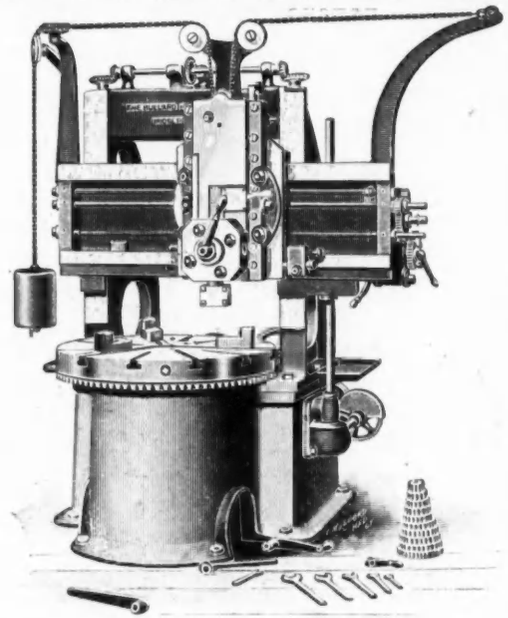


51-*Inch Mill. Double Head.*



42-*Inch Mill. Turret Head.*

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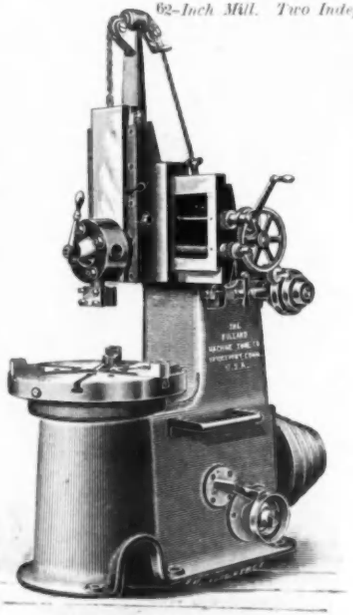

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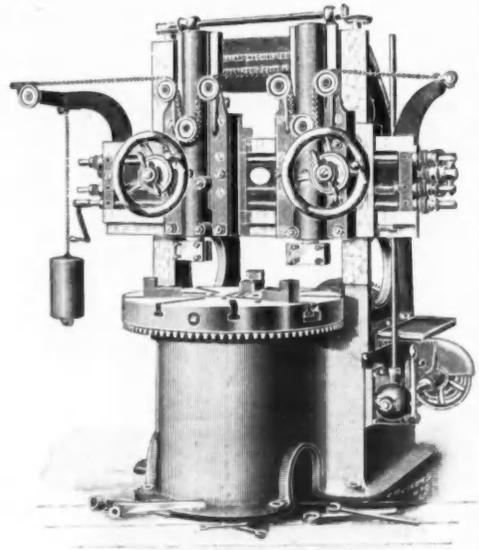

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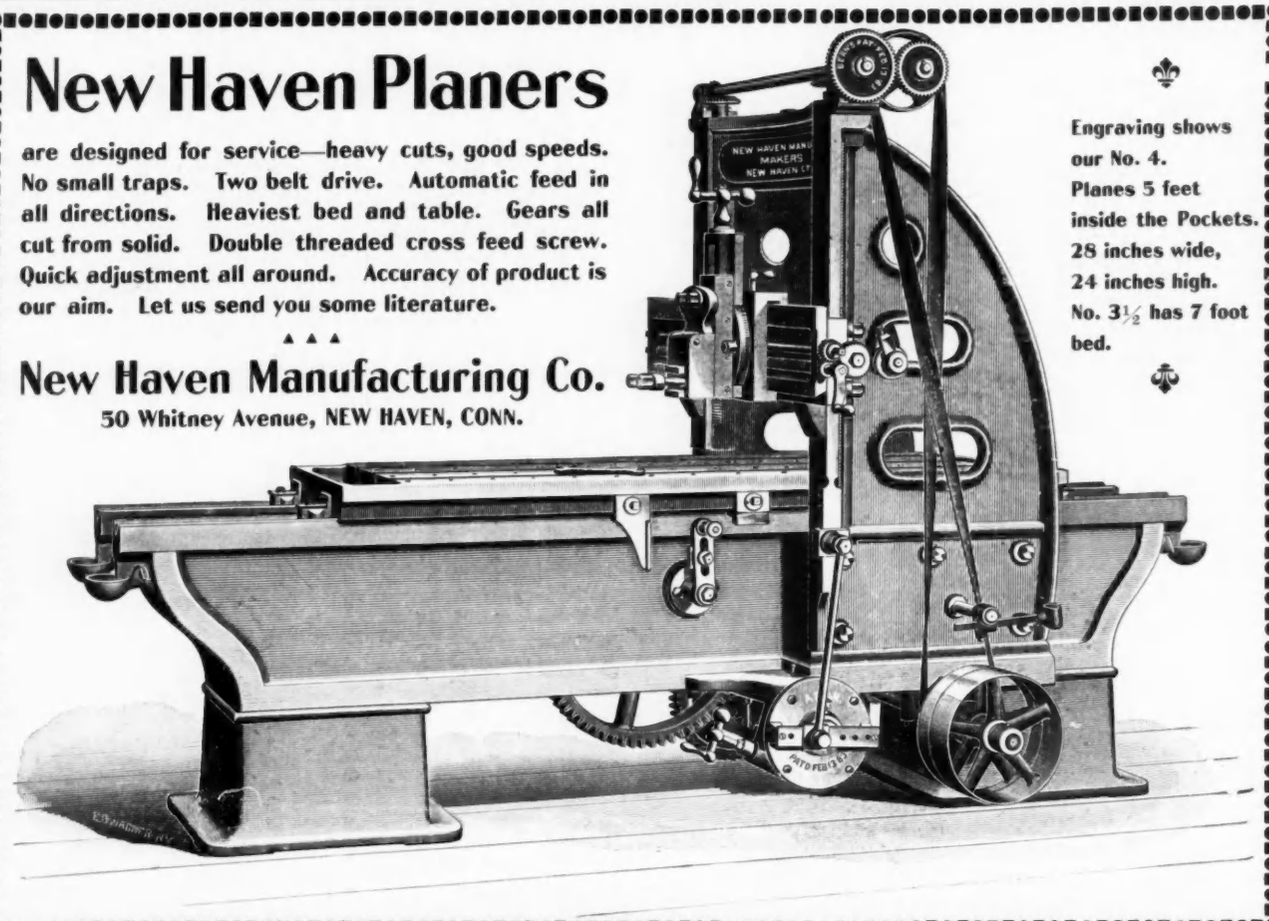

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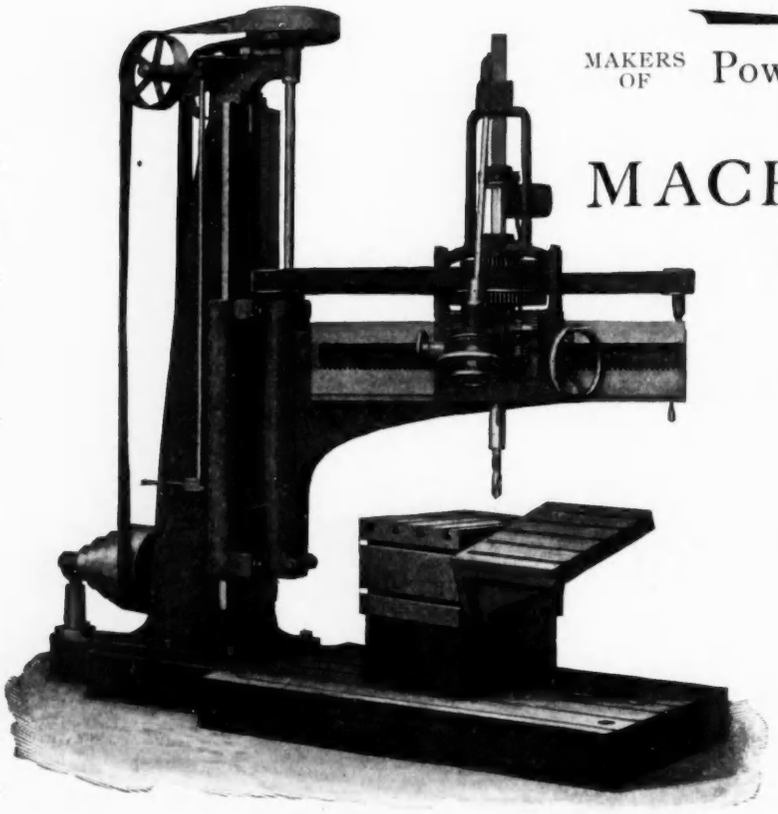

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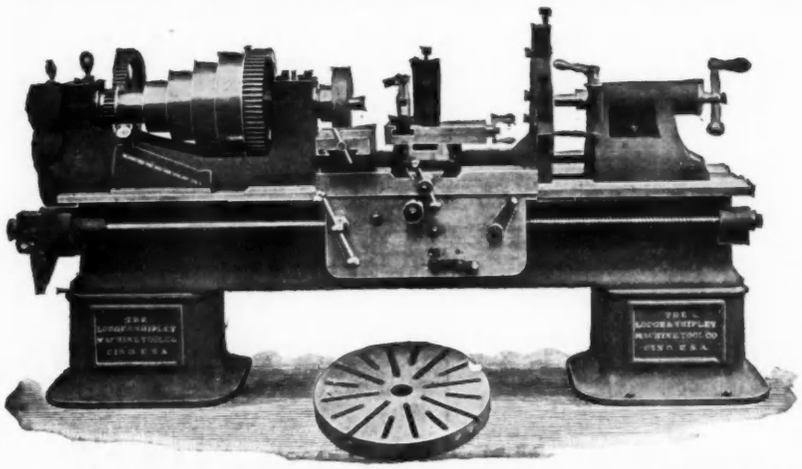

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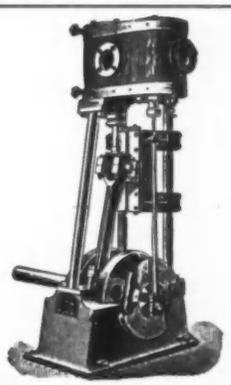

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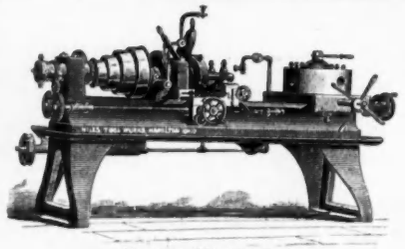

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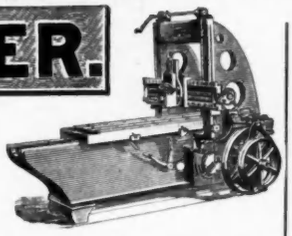

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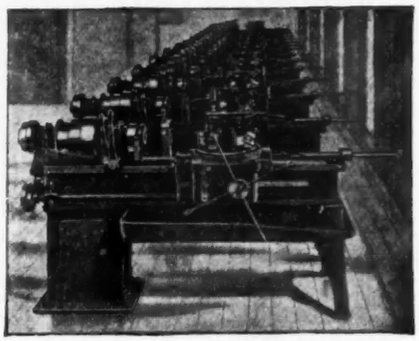

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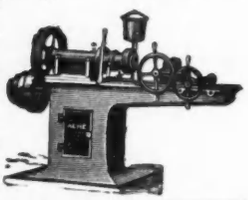

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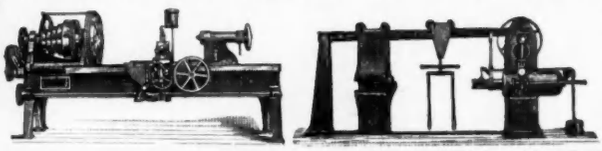

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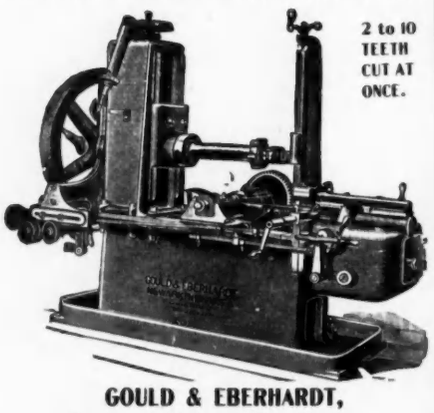

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